MEMOIRS

OF THE

NATIONAL MUSEUM
MELBOURNE

No. 8.

D. J. MAHONY, M.Sc.,
DIRECTOR.

PUBLISHED BY ORDER OF THE TRUSTEES.

Melbourne:
FORD & SON PRESS PTY., LTD. 372 & 374 Drummond Street, Carlton.

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CONTENTS.

NOTES ON AUSTRALIAN ANTS, WITH DESCRIPTIONS OF NEW SPECIES AND A NEW GENUS.

By John Clark, Entomologist, National Museum.

(Plate I.)

In a recent paper dealing with colony-founding by Ants of the genus *Myrmecia* (Science, vol. 76, pp. 532–533, 1932) Dr. W. M. Wheeler gives a description of the queen and her incipient colony; and he deals with the same subject in greater detail in a later publication, in book-form, entitled "Colony-Founding Among Ants," Harvard University Press, 1933. In this fine work the author gives fully the results of his observations in Australia during 1931. In addition to describing colony-founding by the primitive Australian Ponerinae, he has described a number of new forms and supplied notes on many obscure species.

On pages 21–22 he quotes in full an abbreviated account of colony-founding published by me (Victorian Naturalist, xlii, pp. 135–144, 1925). Commenting on my account of these he says (p. 22) :—

> "It would seem, therefore, that the *Myrmecia* queen, apart from feeding her larvae on insect food, founds her colony in precisely the same manner as the young queens of the higher ants. This is not the case, however, since a significant idiosyncrasy of her behaviour has been overlooked, as will appear in my account of *Myrmecia regularis* and several other species."

Regarding *Myrmecia regularis*, he says (p. 26), after dealing with this ant and its habits :—

> "Diligent search enabled me to find more than twenty nest-founding females of *regularis*. Since these must have been fecundated sometime between February and April, 1931, and since in the genus Myrmecia as in other Ponerinae the females and workers differ so little in size, and especially in the relative volumes of the thorax and gaster, as contrasted with the queens and workers of the higher ants, it seemed to me improbable that the *regularis* queen could fast and survive on her small amount of fat and wing-musculature for a period as long as seven or eight months. That we are not compelled to make such a supposition was demonstrated by the following observations.
>
> "I found that each of the females occupied a large flat cell (Fig. 6) varying from $2\frac{1}{2}$ to 4 inches in diameter under a large stone or log rather deeply embedded in the soil. The lower surface of the stone or log formed the roof of the cell; its earthen floor was quite flat and

its walls continuous on all sides. It was always situated nearer the periphery of the stone or log than the centre, so that the outer wall of the cell was quite thin. In most cases a large gallery descended into the soil from the floor of the chamber perpendicularly or obliquely for a distance of about six inches and terminated in a second smaller and more irregular chamber. When the stone or log was turned over the queen fled precipitately into this second chamber, which is therefore used as a retreat in case of danger. It was sometimes difficult to capture the escaped queen because the gallery was often excavated between immovable stones or roots. Usually there was only one female under a stone, but on one occasion I found three, each in a separate cell and separated by nearly a foot of earth from the others. Some of the females were quite alone, but others had a number of eggs scattered on the floor of the upper cell or a small cluster of young or nearly half-grown larvae. The latter were sometimes found feeding on fresh pieces of insects, such as caterpillars and the gasters of deälated ant females of the genera Camponotus and Orthocrema. This food, of course, must be obtained outside the nest, and since the superficial cell is closed off on all sides, we must assume that the *regularis* female does not remain rigidly confined like the females of the higher ants during her whole colony-founding period, but leaves her nest from time to time to secure insect food for her brood and also in all probability, nectar and sap for herself. This is indicated also by the following observations and inferences. First, I have taken a few *regularis* females wandering about in the open. They could not have been recently fecundated individuals because the *regularis* nests contain no young sexual forms during October and November and it was far too early for any nuptial flight of the species. Second, I found two incipient nests, each containing a cluster of sound and active larvae but no females. I could only suppose that they happened to be out foraging at the time when I uncovered their cells. Third, the outermost earthen wall of the cell in several instances looked as if it had been broken open and restored repeatedly. In the case of *Myrmecia analis* mentioned on p. 44 I actually found an opening in this wall! And fourth, the cells inhabited by the females and larvae were always exquisitely clean, indicating that the former must carry all refuse insect food to the outside, as Clark has described (see p. 22) for the adult colonies. I believe, therefore, that the *regularis* female makes her cells soon after her nuptial flight and then leads the life of a recluse till October or November, occasionally breaking through the outer wall and foraging for food. With the return of spring in October the more abundant food-supply enables her to lay a number of eggs and to rear a few larvae with insect food which she captures on similar excursions. Additional evidence of this behaviour is given in connection with several of the following species of Myrmecia."

In the above account some peculiar statements are not quite explained. First, the latter half of the first paragraph on p. 26 would make it appear that I had stated that the queen fasts for a period of seven or eight months while maintaining herself on her body fat. I stated definitely that the larvae are fed on insects, supplied by the queen alone, and that it was six to seven months before the first workers left the cocoons. In this statement Wheeler absolutely supports my observations by the following statement on page 39 :—

> "November 2nd, 1931, I found a very interesting incipient colony of *nigriceps* under a large log at Margaret river, Western Australia. It consisted of the mother, eight small workers, three worker cocoons and several larvae of various sizes."

It is difficult to reconcile this fact when he states on page 29 that the female leads the life of a recluse, until October or November.

The female does not lead the life of a recluse, for all during the winter months she may be found foraging for food both for herself and larvae. I have reared a large number of species in artificial nests and the results correspond with those obtained in the bush. Early in March of last year (1933) a large marriage flight of *Myrmecia forficata* Fab. took place at Ferntree Gully. Three weeks later it was desired to secure some working colonies for demonstration at a natural history exhibition in Melbourne on the 5th to 7th April. Knowing that queens could be obtained there, a representative of the exhibition committee and my daughter Mabel accompanied me to Ferntree Gully to secure material. Within an hour we found several females with their cells complete and some of them with their eggs. One of the females exhibited had fourteen eggs, three of which hatched before the exhibition closed. This female is still alive and well with her larvae; with ordinary care these larvae will have pupated and the ants issued in October or November as found by Dr. Wheeler, and stated by me in 1925.

On pages 49–55 Wheeler deals at length with *Myrmecia (Promyrmecia) aberrans* Forel and its various forms. He says (p. 53–54):—

> "The nests of three of the above described subspecies, *formosa*, *haematosticta* and *maura* are practically identical. Those of the first and second subspecies were found November 26 and 27 near Uralla in open sheep pastures on volcanic soil at an altitude of about 3000 ft. only by patiently following the rare, single workers which were returning home with insect prey. No mound marks the site of the nest, which is a mere hole (Fig. 20) a quarter of an inch in diameter, leading into a perpendicular gallery terminating at a depth of somewhat more than a foot in a small chamber. Usually only three or four workers and no female were found with a small number of cocoons in this chamber. Even including foraging workers a colony can scarcely comprise more than a dozen individuals. They were by no means aggressive. While foraging they crawled about rather slowly and were never seen to climb the vegetation nor to jump like other small species of Myrmecia."

Further on he says (p. 54):—

> "These meager notes indicate, perhaps, that the subgenus Promyrmecia should be retained as defined by Emery, since *aberrans* differs not only morphologically but also ethologically from all the other smaller Myrmecias which Clark has included in the group.

> "The absence of any winged or deälated females of the usual type either amongst the specimens of *aberrans* and its subspecies hitherto collected or in any of the nests which I excavated, raises the question as to the existence of such forms. etc., etc."

A nest of *M. (P.) aberrans* found by me at Altona, Victoria, contained over 50 workers and two females, whilst a nest, in the same locality, taken by Mr. T. Greaves, a young Myrmecologist, had over that number of workers, eight females and seven or eight winged males. The female is ergatoid, as is also the female of an undescribed species in my collection. No winged females have been found, and in that respect this species resembles *Myrmecia esuriens* Fab. of Tasmania. The ethology of *M. (P.) aberrans* does not differ from several of the other small species. The nest and habits of *M. (P.) picta* Smith are similar; these are dealt with below. As to the morphology, when one is familiar with the sexes and forms of all known small species it is at once apparent that if Emery's subgenera are to be maintained it becomes necessary to erect a new subgenus for every second species; the difference so apparent in the workers are, however, not apparent in the males and females, and the subgenera are therefore not justified. With the material already available a complete range of forms exists connecting *M. aberrans* at one end of the group with *M. mandibularis* at the other. While the connection is evident in the workers it is even more so in the females. They must be the deciding factor. At present we know these ants from limited areas only and undoubtedly future collecting will reveal many forms at present not suspected.

In the following pages *Myrmecia (Promyrmecia) aberrans* Forel has been redescribed and the previously unknown male and female described and figured. The much confused species *M. (P.) picta* Smith has also been redescribed in detail and an attempt has been made to clear up the synonymy. A new species, *Myrmecia (Promyrmecia) fucosa* n. sp., has been included to show relationship with *M. (P.) picta* with which it is almost identical in colour, sculpture and pilosity, but with very different mandibles. *Myrmecia esuriens* Fab. has been redescribed and the previously unknown female compared with it. This female is ergatoid (worker-like) and easily overlooked. A new genus *Nothomyrmecia* has been erected to contain a remarkable species from Western Australia. The position of this genus is doubtful. The tribe *Myrmecii*, to which it appears to belong naturally, is characterised as having narrow mandibles and a two-jointed pedicel. These characters cannot be applied to *Nothomyrmecia*; it may, therefore, be necessary to erect a new tribe, *Nothomyrmecii*, to contain this genus.

The types of the new forms are in the National Museum, Melbourne.

Family **FORMICIDAE** Latreille 1810.

Subfamily **Ponerinae** Lepeletier 1836.

Genus MYRMECIA Fabricius 1804.

Subgenus PROMYRMECIA Emery 1911.

Myrmecia (Promyrmecia) aberrans Forel.

(Pl. I, figs. 1, 2.)

Myrmecia aberrans Forel; Ann. Soc. Ent. Belg. xliv, p. 54, 1900, ♀; Rev. Suisse. Zool. xviii, p. 9, 1910, ♀.

Myrmecia (Promyrmecia) aberrans Forel; Emery, Gen. Ins., Fasc. 118, p. 19, 1, fig. 10, 1911, ♀; Clark, Victorian Naturalist, xlii (6), p. 136 and 140, 1925, ♀; Wheeler, Colony Founding Among Ants, Harvard University Press, 1933, ♀.

Worker.—Length, 10–14 mm.

Black; top of the pronotum, mesonotum, epinotum and node, red; mandibles and labrum yellowish red, points of teeth black; antennae and tarsi brownish. Some examples have a reddish tinge on lateral borders of the head behind.

Shining. Head longitudinally striate in middle, the striae between frontal carinae continued from front of clypeus to occipital border; sides of clypeus and antennal depressions not striate, but finely and densely punctate, these fine punctures continued between the striae on head; some large scattered punctures on occipital border. Pronotum longitudinally striate in middle, longitudinally arched at sides above: mesonotum smooth and shining, with some scattered shallow punctures; there are faint traces of fine longitudinal striae on some examples. Epinotum coarsely striate transversely, descending obliquely on the sides; node circularly striate, with a central longitudinal carina; postpetiole, gaster, scapes, and legs very finely and densely punctate.

Hair yellowish, sparse on head and body, more abundant on the apical segments of gaster, but short and erect; shorter and adpressed on the tibia and tarsi, tibia also furnished with some long bristle-like hairs on the underside. Pubescence greyish, very fine and adpressed on clypeus and funiculus; more abundant on postpetiole and gaster, shorter and finer on sides of thorax.

Head very slightly broader than long, broader behind than in front, occipital broader concave, angles broadly rounded. Mandibles short and broad, not as long as head, external border feebly concave at middle; inner border nearly straight to basal third, thence strongly reduced to base; furnished with twelve teeth, first two small, third, fifth, seventh, eighth, tenth and eleventh strong and obtuse; the tenth forms the angle between the two apparent borders. Frontal carinae short, extending to about the posterior third of eyes. Clypeus strongly excised at middle in front, the excision obtuse, sides straight, forming a sharp tooth-like projection on each side. Labrum sharply rounded, projecting outward almost to the points of clypeus. Eyes large, moderately convex; ocelli small. Scapes not extending to occipital

border by one-fifth of their length ; first and second segments of funiculus equal, third somewhat shorter, apical as long as the two preceding together. Thorax twice as long as broad. Pronotum one and one-half times broader than long, broader in front than behind, slightly depressed above. Mesonotum almost circular, very slightly broader than long, convex and rounded above. Epinotum one and one-fifth times longer than broad ; in profile the dorsum and declivity appear as an even arch. Node circular, as broad as long and as broad in front as behind ; the stalk in front very short, barely one-third of the length of node ; in profile a little higher than long, rounded above, anterior and posterior faces vertical ; postpetiole one and one-half times broader than long, broadest at middle. First segment of gaster broader than long, and broader behind than in front. Legs moderately long.

Female.—Length, 16–18 mm. (Ergatoid.)

Colour identical with worker. Sculpture slightly coarser. Pilosity similar.

Apart from the greater size and bulk it closely resembles the worker. The scutellum is very small and inconspicuous. The metanotum is indicated by a sharp ridge. There are no traces of wings, but the anterior wing sclerites are indicated.

Male.—Length, 13–14 mm.

Black. Antennal scapes and first segment of funiculus, femora of all legs, and anterior tibiae and apical segments of tarsi, red ; middle and posterior tibiae brownish.

Mandibles shining, finely punctate. Head finely reticulate, coarser behind, with some large shallow punctures. Pronotum similar. Mesonotum similar in front. Epinotum with coarse reticulations forming faint transverse rugae. Node irregularly rugulose, with a strong longitudinal central carina. Postpetiole and gaster finely and densely punctate.

Hair yellow, erect, long and abundant except on antennae and legs. Pubescence white, very fine, short and adpressed, particularly abundant on gaster.

Head broader than long, broader in front than behind, sides strongly convex, occipital border short and straight. Mandibles short, not raised. Scapes fully twice as long as first segment of funiculus ; second segment four times as long as first. Eyes large, feebly convex, placed in front. Ocelli large. Pronotum short, strongly convex. Mesonotum convex in front, flattened behind, mayrian furrows distinct but not strongly impressed ; parapsidal furrows sharply defined. Scutellum strongly convex above, twice as broad as long. Epinotum twice as broad as long, strongly convex in all directions. Node slightly broader than long, sides strongly convex. First segment of gaster much broader behind than in front. Legs slender. Genitalia retracted.

Habitat.—Victoria, Altona (J. E. Dixon, ☿) ; T. Greaves, ☿ ♀ ♂ ; J. Clark, ☿ ♀) ; Bacchus Marsh and Coburg (C. Oke, ☿ ♀) ; Broadmeadows (F. P. Spry, ☿).

All the females examined are similar to the worker and apart from their greater size are difficult to detect. Ergatoid females occur with several species of the genus, but winged forms also are known with the majority.

Myrmecia (Promyrmecia) picta Smith.

(Pl. 1, figs. 3, 4.)

Myrmecia picta Smith, Cat. Hym. Brit. Mus. vi, p. 146, 1858, ☿ ♀ ; Lowne, The Entomologist, Lond. ii, p. 336, 1865, ☿.

Myrmecia (Promyrmecia) picta Smith ; Clark, Victorian Naturalist, xliv (2), p. 39, 1927, ☿ ♀ ♂.

Worker.—Length, 9–12 mm.

Black. Mandibles, clypeus, front of face, to about the hind margin of eyes, yellow ; antennae and anterior legs reddish-yellow ; intermediate and posterior legs brownish ; tarsi lighter. The colour of the thorax and nodes is most variable, ranging from all black on some specimens, to all red on others. The most numerous individuals have the head, behind the eyes, pronotum and a spot on mesonotum, black ; edges of mesonotum, all the epinotum, node and greater portion of postpetiole red, or reddish-yellow. The gaster always black.

Head longitudinally striate, finely and densely reticulate between the striae. Mandibles shining, with scattered elongate punctures. Pronotum transversely arched, striate-rugose, in some specimens almost longitudinally arched. Mesonotum finely transverse rugose, in a few examples almost smooth. Epinotum transversely, often irregularly, rugose, definitely striate on declivity. Node irregularly rugose. Postpetiole and gaster very finely and densely punctate.

Hair yellowish, erect, rather long and abundant throughout, none on scapes, longer and more abundant on apical segments of gaster than elsewhere. Pubescence greyish, very fine and abundant, particularly on postpetiole and gaster, frequently appearing as a greyish covering.

Head as long as broad, broader in front than behind, occipital border nearly straight, angles rounded. Mandibles not as long as head, external border concave at middle. Inner border nearly straight to basal fifth, thence sharply reduced to base ; furnished with nine teeth, first two small, third, fifth, seventh and nine twice as large ; the ninth forms the angle between the two apparent borders. In some examples there is indication of a tooth on basal border but this is usually edentate. Frontal carinae short, almost parallel. Clypeus strongly excised at middle in front, inner edges straight. Labrum projecting almost to points of clypeus, anterior border feebly rounded. Eyes and ocelli large and convex. Scapes not extending to occipital border ; second segment of funiculus one-third longer than first and third, fourth to eighth equal, ninth and tenth shorter, apical as long as the two preceding together. Thorax fully two and one-half times as long as broad. Pronotum almost twice as broad as long, dorsal surface slightly rounded. Mesonotum circular, rounded above. Epinotum longer than broad, without a boundary between dorsum and declivity ; the latter short. Node broader than long, slightly broader behind than in front ; in profile much higher than long, rounded above, the stalk in front short, not half the length of node, anterior face nearly vertical, posterior face sloping behind. Postpetiole one and three-fourths times broader than long, much broader behind than in front, convex on sides and above. First segment of gaster broader than long. Legs long and moderately slender.

Female.—Length, 13.5–14.5 mm.

Differs from the worker only by larger size and in possessing wings. The colour appears to be more constant. In all the examples examined the occiput, pronotum, margins of the other segments and gaster are blackish; the mesonotum, scutellum, epinotum, node and postpetiole red. All the legs are uniformly castaneous, except the apical half of posterior femora, which are brown. Front of face bright yellow. Four corners of node more clearly defined, but not sharp. Wings hyaline. Ergatoid females also are present.

Male.—Length, 10-11 mm.

Black; mandibles, five basal segments of antennae, front of face and all the legs, yellow; eight apical segments of antennae, brown.

Head finely striate-rugose on middle, becoming coarser at lateral and occipital borders. Mandibles shining, coarsely and sparsely punctate. Pronotum, scutellum, mesonotum and epinotum coarsely reticulate-punctate. Node coarsely and irregularly rugose. Postpetiole and gaster very finely and densely punctate.

Hair greyish, long and suberect, longer and more abundant on head and thorax than on gaster, short and adpressed on legs, none on antennae. Pubescence greyish, short, most abundant on gaster.

Head broader than long, broader in front than behind; occipital border convex. Mandibles short, triangular, external border convex; diverging behind. Clypeus long, convex and rounded above, concave at middle in front. Antennae long and slender; scapes short; first segment of funiculus half as long as scapes, second three and one-half times as long as scape, third slightly shorter than second, the others about equal. Thorax barely twice as long as broad. Pronotum strongly rounded in front and above. Mesonotum large, convex and rounded above, mayrian furrows distinct; a deep longitudinal suture extends from anterior border to near base; parapsidal furrows faintly defined. Scutellum broad, strongly convex. Epinotum strongly convex and rounded above, without a boundary between the dorsum and declivity. Node slightly broader than long, almost circular, strongly convex above. Postpetiole broader than long, broadest just behind the middle, strongly convex above and on sides. First segment of gaster broader than long. Pygidium convex and rounded. Cerci long and pointed. Genital armature; annular lamina short, about one-third of the length of squamulae, latter slightly longer than broad, broader behind than in front, sides evenly convex; in profile strongly convex and rounded above. Stipites long and bluntly pointed, curved inward and slightly upward at the point. Volsella long, laminate, pointed at tip. Lacinia short, laminate. Sagittae long thickened towards apex. Straight above to near apex then curved upward; apical face vertical, rounded above and below, with a row of small, sharp teeth at lower third, directed downward. Subgenital lamina one and one-fourth times longer than broad at base, strongly reduced from basal third to apex; this feebly concave, nearly straight, without a projection at middle in front. Stipites, apex of squamulae and of subgenital lamina, punctate. Hair yellowish, erect, long and pointed on stipites and subgenital lamina, shorter and suberect on squamulae. Legs long and stout.

Habitat.—Western Australia: Merriden (L. J. Newman), National Park and Mundaring (J. Clark), Yellowdine (W. Joyce). South Australia: Mt. Lofty (A. H. Elston). Victoria: Maldon (J. C. Goudie), Mallee (J. E. Dixon), Wyperfield (J. Clark). New South Wales: Broken Hill (F. W. Shepherd), Narrabri (W. W. Froggatt).

The colour varies considerably in the individuals of a single colony. Many specimens are entirely black, with the exception of mandibles, front of face, antennae and anterior legs. Others have thorax, petiole and anterior half of postpetiole entirely red or variously marked with red. The extent of yellow area on front of face also varies slightly. In some examples this does not pass anterior margin of eyes, whilst in others it extends well beyond posterior margin. Although the colour varies considerably, the sculpture, pilosity and pubescence are constant. The same colour varieties occur in all colonies obtained from each state.

This species is one of the most confused in the genus. Judging from the works of other Myrmecologists it had not been seen since Lowne recorded it from Sydney. There is little doubt as to the form taken by Lowne, as he appears to have written his paper with the assistance of Smith. He records *M. picta* immediately preceding the description of *M. urens*, a species which has apparently been mistaken for *M. picta* by Mayr, Forel and Emery. In order to be certain of this, and of Smith's other species of the genus, specimens were forwarded to my friend Mr. W. C. Crawley, who compared them with the types in the British Museum. In addition to sending notes, Mr. Crawley made drawings of the various types. A comparison with these shows clearly that the species regarded by both Mayr and Forel as *M. picta* is really that described by Lowne as *M. urens*. Forel records *picta* from Fremantle and added two varieties from that locality. The species found at Fremantle is not *picta*, and the two varieties described do not belong to this species.

The confusion undoubtedly arises from Smith's rather poor descriptions in 1858, but he certainly states clearly that the front of the face is yellow, none of the others has a yellow face. In 1865 Lowne recorded *picta* from Sydney and on the same page described *urens* which superficially resembles *picta*, but actually is not connected with it. In 1866 Mayr described *pumilio* from Queensland, and later (1876) lumped all together as one variable species. From his remarks it is evident that he never saw *picta* and had confused *urens* with *pumilio*. Specimens of *pumilio* in the National Museum collections, received from the Godeffroy Museum in 1888, are the true *pumilio*, from Rockhampton, Queensland. The synonymy of this confused group is as follows :—

MYRMECIA (PROMYRMECIA) PICTA Smith :

Myrmecia picta Smith, Cat. Hym. Brit. Mus. vi, p. 146, 1858, ♀ ♀ ; Lowne, The Entomologist, Lond. ii, p. 336, 1865, ♀ ; Mayr, Jour. Mus. Godeffroy, xii, p. 94, 1876, ♀ ; Emery, Gen. Ins., Fasc. 118, p. 20, 1911, ♀ ♀.

Myrmecia (*Promyrmecia*) *picta* Sm., Clark, Victorian Naturalist, xliv (2), p. 39, 1927, ☿ ♀ ♂.

MYRMECIA (PROMYRMECIA) URENS Lowne :

Myrmecia urens Lowne, The Entomologist, London, ii, p. 33, 1865, ☿.
Myrmecia picta Mayr, Jour. Mus. Godeffroy, xii, p. 94, 1876, ☿.

MYRMECIA (PROMYRMECIA) PUMILIO Mayr :

Myrmecia pumilio Mayr, Verh. Zool. bot. Ges. Wien, p. 896, 1866, ☿.
Myrmecia picta Mayr, Jour. Mus. Godeffroy, p. 94, 1876, ☿.

MYRMECIA (PROMYRMECIA) INFIMA Forel :

Myrmecia picta var. *infima* Forel, Ann. Soc. Ent. Belg. 44, p. 54, 1900, ☿ ; Emery, Gen. Insect. Fasc. 118, p. 20, 1911, ☿.

Myrmecia (*Promyrmecia*) *infima* Forel, Wheeler, Colony Founding Among Ants, p. 62, 1933.

Myrmecia picta var. *nigra* Forel, Fauna Sudwest. Aust. i, p. 267, 1907, ☿ ; Emery, Gen. Ins. 118, p. 20, 1911, ☿.

The nest is constructed in the ground ; it is insignificant, and easily overlooked unless the ants are seen to enter or leave, there being no mound. Access to the nest is gained by one small vertical shaft or by several scattered over the area ; the entrances rarely exceed a quarter of an inch in diameter. They extend downward for about eighteen inches, the usual depth of the nest. The soil excavated is carried some distance and scattered, never piled up round the entrance as is usual with most species in the genus. The excavations are not large, consisting only of a few small pockets. The first of these occur just under the surface, others at greater depths. Larvae and pupae can be found generally in the top pockets. At the first alarm they are seized by the workers and carried below to the bottom chamber, and it is, therefore, not possible to state the normal distribution of these in the nest. An interesting feature is that several, and sometimes ergatoid, females may be found in one nest. They can be seen hunting with the workers and carrying food. All the females I have taken have been in perfect condition, so they must live and work together in peace and harmony. It is not usual in this genus, except in a few species, to find more than one female in a nest. They can be found running up and down the trunks of trees which are in blossom. They sip the nectar, and capture small bees and other insects with which they feed the larvae.

This ant will rarely come out to attack, even when one is standing on the nest, but will, however, readily attack when it is outside. This feature is rare in the genus ; most of the species do not need inviting, and they rush out at the least

alarm. The males and females are in flight during January and February.

Myrmecia (Promyrmecia) fucosa, sp. nov.

(Pl. I, figs. 5, 6.)

Worker.—Length, 10–11.5 mm.

Red. Posterior half of head and two apical segments of gaster black. Mandibles and front of face to about the middle of eyes yellow; antennae and anterior legs testaceous; middle and posterior legs brownish.

Head longitudinally and irregularly rugose, densely and finely reticulate between the rugae. Mandibles smooth and shining, with some scattered shallow punctures. Pronotum transversely arched-rugose. Mesonotum finely transverse striate. Epinotum transversely striate-rugose, coarser than on mesonotum but not so coarse as on pronotum. Node strongly and irregularly rugose. Postpetiole and gaster very finely and densely punctate.

Hair greyish, long and erect, abundant on whole body, except the scapes, shorter and suberect on funiculus and legs. Pubescence greyish, long and abundant on postpetiole and gaster, forming a distinct covering, sometimes hiding the sculpture; sparse elsewhere.

Head slightly longer than broad, broader in front than behind, occipital border feebly concave, angles rounded. Mandibles not as long as head; external border almost straight to apical third; inner border nearly straight to basal third, then greatly reduced to the base; furnished with nine teeth, the third, fifth, seventh, eighth and ninth twice as large as the first two; the eighth forms the angle between the two apparent borders, the ninth placed just in front of middle of basal border. Frontal carinae extending to the posterior margin of eyes. Clypeus obtusely excised at middle in front; anterior corners produced as blunt tooth-like angles. Labrum broadly rounded, extending outward to apex of clypeus. Eyes and ocelli large and prominent. Scapes not extending to the occipital border; first segment of funiculus slightly shorter than second, but longer than third, apical one and one-half times longer than tenth. Thorax two and one-half times as long as broad. Pronotum broader than long. Epinotum about one and one-half times as long as broad, boundary between the dorsum and declivity feebly indicated. Node as long as broad, slightly broader behind than in front; in profile slightly longer than high, nearly flat above, anterior face vertical, posterior face descending in a gradual slope; the stalk in front is not quite half the length of node; postpetiole very slightly broader than long, much broader behind than in front. First segment of gaster as broad as long, slightly broader behind than in front. Legs moderately long and slender.

Female.—Length, 11–13 mm.

Resembles the worker, but much larger and winged. The sculpture slightly coarser on head, thorax and node. The colour is similar, except that on two females examined the scutellum and sides of the mesonotum are brown, or blackish.

Male.—Unknown.

Habitat.—Victoria: Lake Hattah, Ouyen ♀ (J. E. Dixon), Sea Lake ♀ (J. C. Goudie), Wyperfield ♀ ♀ (J. Clark). South Australia: Murray Bridge (A. M. Lea, ♀).

At first sight this appears to be a variety of *M. (P.) picta* Sm., which it resembles in size and colour. It is, however, readily distinguished from it by the form of the mandibles, antennae and nodes.

The mandibles of *fucosa* and of *nigrocincta* are somewhat similar, but the difference in the antennal scapes prevent the two species from being placed together.

The nest and habits are similar to those of *M. (P.) picta.*

Genus MYRMECIA Fabr. 1804.

Myrmecia esuriens Fabr.

(Pl. I, figs. 7, 8.)

Syst. Piez., p. 424, 1804, ♀.
Myrmecia tasmaniensis Smith, Cat. Hym. Brit. Mus. vi, 147, 1858, ♀.
Myrmecia walkeri Forel, Ann. Soc. Ent. Belg., 37, p. 456, 1893, ♀.
Myrmecia esuriens Fabr. Emery, Gen. Ins. Fasc. 118, p. 21, 1911, ♀.

Worker.—Length, 14–18 mm.

Black. Mandibles, labrum, antennae, legs, coxae, postpetiole and apical segments of gaster ferruginous.

Head longitudinally rugose. Pronotum arched rugose, the rugae irregular, sometimes almost longitudinal in the centre. Mesonotum and epinotum transversely rugose. Node coarsely and irregularly rugose. Postpetiole and gaster fine and densely punctate.

Hair yellow, erect, short and abundant on head, thorax and nodes, longer on gaster; very short, suberect and scattered on legs, not apparent on antennae. Pubescence very fine, adpressed, moderately abundant throughout, much longer and very abundant on gaster where it forms a distinct yellowish covering.

Head as long as broad, occipital border straight, sides convex, the angles rounded. Mandibles slightly shorter than head, external border concave in middle; inner border strongly reduced from fourth large tooth to base. Scapes extending beyond occipital border by the length of first segment of funiculus; second segment one-fourth longer than first, third shorter than first. Thorax two and one-half times longer than broad. Node one-third broader than long, broader behind than in front: in profile higher in front than behind, the anterior face vertical, dorsum and posterior face united in a curve, the stalk in front very short. Postpetiole one and one-half times broader than long. First segment of gaster broader than long. Legs short and robust.

Female.—Length, 22–24 mm. (Ergatoid).

Similar to the worker but larger and the sculpture coarser. Postpetiole darker, more brownish. Head square, as broad in front as behind. Scapes extending beyond occipital border by their thickness. The thorax bears a very small scutellum, but has no traces of wing insertions. Node transversely oval, one and one-half times broader than long. Postpetiole one-fourth broader than long. Legs robust.

Male.—Length, 16 mm.

Black. Mandibles, labrum, antennae, legs, coxae, petiole, postpetiole, first and last segments of gaster ferruginous; apical margins of other segments of gaster ferruginous.

Head longitudinally rugose. Thorax and node irregularly and coarsely punctate, almost rugose. Epinotum more finely so. Postpetiole and gaster very finely and densely punctate.

Head broader than long, strongly convex behind and on the sides. Mandibles short, triangular, inner and basal borders of equal length, the former concave, with a short tooth in middle, the point and basal angle forming broad blunt teeth. Clypeus convex, produced and feebly concave in front. Frontal carinae short, widely diverging behind. Eyes large and convex, occupying almost half the sides of head. Ocelli large and convex. Antennae long and slender. Scapes twice as long as first segment of funiculus; second segment six times as long as first, the others subequal to apical which is one-fourth longer than the preceding. Thorax two and one-half times longer than broad. Pronotum short, convex in front and on sides. Mesonotum as long as broad, mayrian furrows deeply impressed, parapsidal furrows fine, but distinct. Scutellum broader than long, strongly convex above. Epinotum convex transversely and longitudinally, merged into declivity without traces of a boundary. Node broader than long, much broader behind than in front, convex in all directions; a sharp longitudinal carina on dorsum; in profile dome-shaped, the stalk in front as long as that behind. Postpetiole almost one-third broader than long. First segment of gaster broader than long, much broader behind than in front. Legs long and rather robust. Wings hyaline.

Habitat.—Tasmania: Hobart (C. Lord, Dr. G. A. Waterhouse ☿), Frankston (A. M. Lea ☿), Mt. Wellington (C. Lord), Nat. Park (R. Blackwood ☿ ♀ ♂; F. E. Wilson ☿ ♀).

This very distinct species is found only in Tasmania. The colour and size render it easily recognisable from all others. The female is almost identical with the worker except for size. The very small scutellum is easily overlooked, and the wing pads are entirely missing.

It is owing to the researches of Mr. R. Blackwood, of the Melbourne University, that I have been able to describe the male and female of this species. No other form of female could be found in or near the nests. Mr. Wilson found a populous colony nesting in a large rotten log, from which he secured the female as well as a large number of workers.

Genus NOTHOMYRMECIA, gen. nov.

Worker.—Slender. Head broader behind than in front. Mandibles elongate, not as long as head, broad and rather flattened; inner borders straight to basal fourth then abruptly reduced to base, forming a short, concave, edentate, basal border, inner border furnished with ten or twelve small sharp teeth equally spaced from the very sharp apex to basal angle, between these teeth are minute denticles. Maxillary palpi with six segments. Labial palpi

with four segments. Clypeus large, convex, produced and convex in front. Labrum produced beyond clypeus, sharply pointed in front. Frontal area large. Frontal carinae erect, narrow and almost parallel, not covering the antennal insertions. Antennae long and slender, twelve segments; scapes longer than head, slightly thickened toward apex; funiculus filiform, second segment longest. Eyes large and convex, placed at middle of sides of head. No ocelli. Thorax not margined. Pro-mesonotal suture sharply impressed. Meso-epinotal suture deep and wide. Petiole elongate, with a large node behind; ventral surface with a strong sharp tooth-like projection in front. Postpetiole united with gaster without traces of a constriction, bell-shaped in front; the ventral surface with a long sharp tooth-like projection in front. Gaster ovate, longer than broad. Sting very long and stout. Legs rather long and robust. Anterior tibiae with one long broad pectinate spur and two short stout bristles. Middle tibiae with two long sharp bristle-like spurs. Posterior tibiae with one long broad pectinate spur and one long thin bristle-like spur. Fourth segment of all tarsi bilobed. Claws stout, bidentate.

Genotype, *Nothomyrmecia macrops*, sp. nov.

Near Myrmecia from which it is readily separated by the form of the head, mandibles, clypeus, eyes and the lack of ocelli as well as the postpetiole which is not constricted behind to form a second node. It is not near any other existing genus.

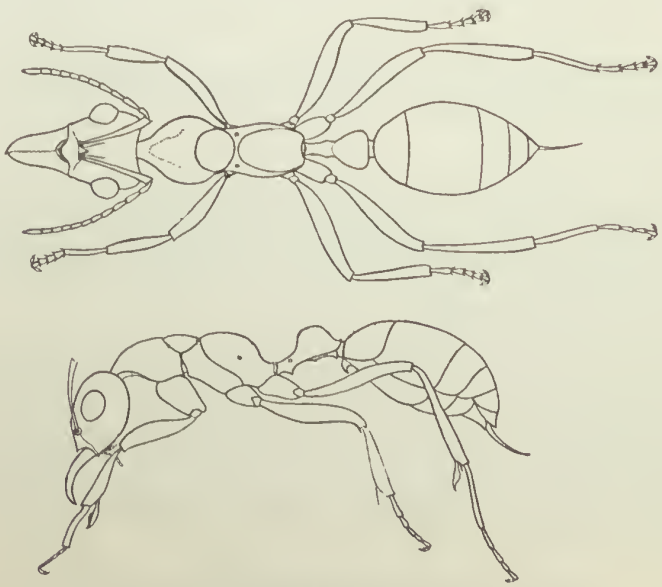


Fig. 1. Nothomyrmecia macrops, sp. nov.

Nothomyrmecia macrops, sp. nov.

(Text fig. 1.)

Worker.—Length, 9.7–11 mm.

Testaceous, basal half of first segment of gaster darker. Mandibles, clypeus, antennae and legs pale yellow.

Mandibles very finely and densely punctate, with a row of large punctures along inner border at base of teeth. Clypeus and head very finely and superficially reticulate. Pronotum finely rugose, the rugae forming feeble transversely arched ridges. Mesonotum finely reticulate with a few large shallow punctures. Epinotum transversely and finely rugose. Node smooth in front, finely reticulate and with a few large punctures behind. Postpetiole gaster, antennae and legs microscopically punctate.

Hair yellow, erect, moderately long and abundant throughout, shorter and suberect on antennae and legs. Pubescence white, very fine and adpressed, abundant throughout but not hiding the sculpture.

Head as long as broad, much broader behind than in front, broadest just behind the eyes, sides convex, occipital border strongly concave, angles strongly rounded. Mandibles shorter than head, external borders straight to apical third then rounded inward and downward; inner border straight to basal fourth then abruptly reduced to base, furnished with ten or twelve small sharp teeth, about equally spaced along the edge, with minute denticles between them, basal angle sharp, apex long and pointed. Clypeus feebly convex above, produced and convex in front. Frontal carinae erect, almost parallel, extending backward level with middle of eyes, not covering the antennal insertions in front. Eyes large and convex, placed at middle of sides slightly on top, occupying fully one-third of sides. No ocelli. Scapes extending beyond occipital border by one-fifth their length, slightly thickened toward the apex; second segment of funiculus one-fourth longer than first, third and fourth, these equal in length, fifth to tenth becoming gradually shorter, apical as long as the two preceding together. Thorax two and three-quarters times longer than broad. Pronotum slightly broader than long, strongly convex in all directions. Mesonotum almost as long as broad, almost circular, strongly convex transversely. Epinotum longer than broad, convex in all directions; in profile the dorsum and declivity strongly convex without traces of a boundary. Node slightly broader than long, bluntly pointed in front, convex in all directions; in profile longer than high, dome shaped but slightly higher in front than behind, one-third longer than the stalk in front; ventral surface with a long broad bluntly pointed tooth in front directed downward. No traces of a constriction between the postpetiole and gaster. Postpetiole twice as broad as long, bell-shaped; ventral surface with a long sharp, hook-shaped, semi-transparent tooth directed backward. First segment of gaster one-third broader than long, broader behind than in front, sides strongly convex. Sting very long and stout. Legs robust.

Habitat.—Western Australia, Russell Range (Miss A. E. Baesjou).

Described from two examples captured by Miss Baesjou near the Russell Range, inland from Israelite Bay.

This remarkable ant is not closely related to any other known to me. The long broad jaws with very fine sharp teeth, meeting

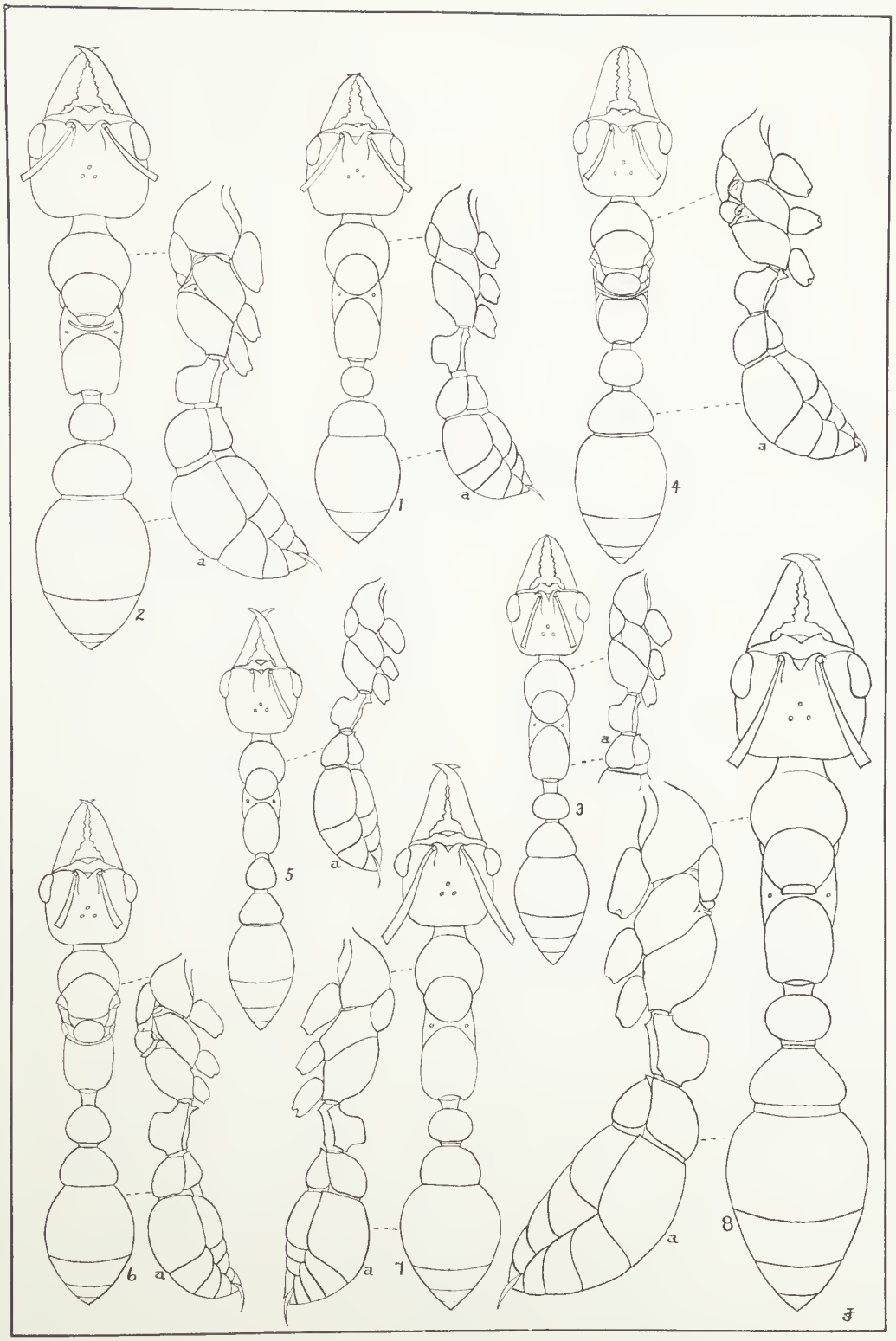
along the full length of their inner border, suggest that it is predaceous ; this is further suggested by the very large eyes and long strong legs. The head and gaster are not like those of any other Australian Ponerine, but the thorax and node are identical with that of the genus *Myrmecia*. Although much smaller this species more closely resembles *Myrmecia* s. str. than its subgenus *Promyrmecia*.

From the description of *Prionomyrmex*, from the Baltic Amber, the head and mandibles appear to be somewhat similar but the nodes are different.

Beyond those collected by Miss Baesjou very few species of ants have been seen from the great stretch of country lying between Albany, Western Australia, and Port Lincoln, South Australia. Thanks to this keen artist-naturalist many new and rare species have been brought to light, clearly showing that some of these ancient ranges contain many primitive forms at present unknown.

Plate I.

Figs. 1, 2.—*Myrmecia* (*Promyrmecia*) *aberrans* ; worker (1) and female (2).
Figs. 3, 4.—*M.* (*P.*) *picta* Smith ; worker (3) and female (4).
Figs. 5, 6.—*M.* (*P.*) *fucosa* sp. nov. ; worker (5) and female (6).
Figs. 7, 8.—*M. esuriens* Fabr. ; worker (7) and female (8).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NEW AUSTRALIAN ANTS.

By John Clark, Entomologist, National Museum.

(Plates II and III.)

Several interesting species are described in the following pages. Amongst these may be mentioned the remarkable species referred to as *Bothriomyrmex wilsoni* n. sp. which appears to be a parasitic form. Although described as a worker it is probable that this is really a female. Three examples were obtained in a nest of *Crematogaster laeviceps* Smith. This is the second Australian species of the genus to be taken actually in nests of other ants. Females of *Bothriomyrmex scissor* Crawley were found in nests of *Iridomyrmex innocens* Forel, but all the examples taken are well developed winged females with normal gaster.

The genus *Myrmecorhynchus*, until now represented by a single species, appears to be well represented in Australia. In addition to the previously unknown male and female other four species have been added to the genus. The habits of this group are not fully known; the typical form *M. emeryi* Andre is generally found under stones or logs; *M. nitidus* n. sp. has been taken in trees, seventy feet from the ground.

The genera *Ectomomyrmex* and *Lordomyrma* are each represented in Australia by one species, a second is here included in each. The remaining species belong to genera which are well represented in Australia.

Thanks are due to the authorities of the British Museum, South Australian Museum, Australian Museum and Queensland Museum for the loan of material for examination and descriptions.

Except where otherwise mentioned the types are in the National Museum of Victoria.

Family **FORMICIDAE** Latreille 1810.

Subfamily **Dorylinae** Leach 1850.

Genus AENICTUS Shuckard 1840.

Aenictus exiguus, sp. nov.

(Pl. II, Fig. 1.)

Worker.—Length, 1.7 mm.

Ochraceous, antennae and legs paler yellow. Smooth and shining, with scattered, shallow, piligerous punctures.

Hair yellow, short and suberect, more abundant on antennae and legs than elsewhere.

Head a little longer than broad, broader in front than behind, sides and occipital border convex. Mandibles narrow, terminal border short, furnished with two large teeth; the second forms the angle between the borders, the first situated midway between second and apex which is long and pointed. Clypeus short and transverse. Frontal carinae very short. Scapes extending slightly beyond middle of head; gradually thickened to apex; first segment of funiculus slightly longer than broad, second to eighth as broad as long, apical twice as long as broad, and longer than the four preceding together. No trace of eyes. Thorax two and one-half times longer than broad, without traces of sutures, constricted at mesonotal region; in profile pronotum and mesonotum form a slight convexity, a feeble depression at meso-epinotal suture, more clearly shown on sides, epinotum feebly convex, almost straight, declivity short, fully half the length of dorsum. Node slightly longer than broad, almost parallel, sides feebly convex; in profile as high as long, anterior face and dorsum united in an even curve, a short broad projection below directed forward. Postpetiole as broad as long, broadest behind, sides convex; in profile as high as long, dorsum convex, a short sharp projection in front below, directed forward. First segment of gaster one-third longer than broad, almost three times broader behind than in front, sides strongly convex. Legs robust, femora and tibia thickened toward apex.

Habitat.—N. Queensland, Cairns District (A. M. Lea). Type in South Australian Museum.

The smallest species of the genus so far recorded from Australia.

Subfamily **Cerapachyinae** Forel 1893.

Genus PHYRACACES Emery 1901.

Phyracaces grandis, sp. nov.

(Pl. II, fig. 2.)

Worker.—Length, 9.8 mm.

Yellowish red; scapes and legs red; funiculus darker; eyes, lateral margins of head, thorax and nodes black.

Smooth and shining throughout, except pygidium which is finely and densely punctate.

Hair reddish, long and suberect, rather sparse except on apical segments of gaster, short but abundant on antennae and legs. Pubescence not apparent.

Head as broad as long, broadest behind, sides convex, occipital border straight, angles rounded. Mandibles short, triangular, furnished with eight small teeth. Clypeus short and truncate. Frontal carinae erect, parallel, confluent behind. Carinae of cheeks prominent, barely as long as frontal carinae. Eyes large and convex, placed at middle of sides. Ocelli prominent, yellowish. A strong lateral carina extends from the posterior inferior angle to near the posterior margin of eye. Antennae short and robust. Scapes extending to posterior ocellus, greatly thickened to apex; first segment of funiculus half as long as second, the others gradually increasing in length to

apical which is twice as long as the preceding. Thorax one and three-quarters times longer than broad, as broad in front as behind, strongly constricted at mesonotal region ; anterior border of pronotum convex and feebly margined, sides strongly convex and margined. Mesonotal sutures very feebly indicated, the sides not margined. Epinotum strongly convex and margined. In profile the thorax convex longitudinally, the declivity short and steep, flat, the sides margined. Node broader than long, anterior border straight, submarginate, the sides strongly convex and margined, posterior border one-third shorter than anterior, deeply concave, terminating in teeth-like angles behind, raised slightly upward ; in profile slightly longer than high, the dorsum flat, or very feebly convex, anterior face vertical ; the ventral surface with a short, broad, bifid projection directed backward. Postpetiole one-third broader than long, broader behind than in front. Pygidium feebly concave, sides submarginate, carrying a row of short, sharp, brown bristles. Legs robust ; posterior coxae with a broad translucent lamina on top behind.

Habitat.—South Australia. Type in British Museum (F. Smith collection).

Near *P. heros* Wheeler, from Queensland. Readily distinguished by the shape of the head, thorax, node and postpetiole, as well as by the colour.

It is interesting to note that of the forty species contained in this genus the workers of three are provided with ocelli. In the present work other four of this ocellied group are added, making a total of seven. With the exception of *P. greavesi* n. sp. all are large and appear to form a distinct group. The sexes, however, cannot be separated from those of the non-ocellied group.

Phyracaces pictus, sp. nov.

(Pl. II, fig. 3.)

Worker.—Length, 8.8 mm.

Mandibles, thorax and node red ; head brown ; antennae, legs and postpetiole blackish brown ; eyes, margins of head, thorax, nodes and whole of gaster black.

Smooth and shining, with scattered, shallow piligerous punctures. Mandibles strongly punctate, front of face finely reticulate.

Hair reddish yellow, long, suberect, abundant throughout, particularly at apex of gaster, rather long and erect on antennae, shorter and adpressed on legs. Pubescence whitish, very fine and adpressed, apparent only on antennae and legs.

Head as long as broad, broadest behind, sides and occipital border convex, angles strongly rounded. Mandibles edentate. Clypeus very short and abrupt. Frontal carinae short, erect and rounded, truncate behind. Carinae of cheeks prominent. Eyes large and convex, slightly in front of middle of sides. Ocelli prominent, anterior largest. A strong carina extends from the inferior-posterior angle to posterior margin of eye. Scapes extending beyond posterior border of eyes by their thickness at apex ; first to sixth segment of funiculus longer than broad, seventh to tenth as broad as long, apical barely as long as two preceding together. Thorax barely one and three-quarters times longer than

broad, as broad behind as in front; anterior angles bluntly rounded. Sides of mesonotum constricted, submarginate, the sutures very feebly indicated. Sides of epinotum convex and strongly marginate, ending in a sharp tooth-like angle, posterior not marginate. In profile thorax convex longitudinally, declivity short and flat, marginate on sides. Node one-third broader than long, almost one and one-half times broader in front than behind, anterior border concave, submarginate, sides feebly convex, anterior angles rounded, posterior border strongly concave, the angles produced as sharp teeth directed upward; in profile as high as long, dorsum flat, anterior face at a right angle; a broad blunt tooth in front below. Postpetiole one-fifth broader than long, parallel, anterior border and sides marginate and straight, angles rounded. First segment of gaster almost one-third broader than long, broadest behind. Legs short and robust.

Habitat.—Victoria: Western District.

The colour of this species is almost identical with that of *P. rotula* Forel.

Phyracaces princeps, sp. nov.

(Pl. II, fig. 4.)

Worker.—Length, 9–10 mm.

Bright ferruginous; eyes, ocelli, margins of thorax, node and postpetiole black.

Smooth and shining. Microscopically reticulate throughout.

Hair reddish, erect, long and abundant. Pubescence not apparent.

Head as broad as long, occipital border short and straight, sides strongly convex, as broad in front as behind. Mandibles with a sharp cutting edge, edentate. Clypeus short and abrupt, broadly rounded. Frontal carinae erect, truncate and converging behind. Scapes gradually thickened to their apex, extending backward to about middle of eyes; first segment of funiculus one-fifth shorter than second, as long as broad, second longer than broad, third to tenth broader than long, apical as long as the two preceding together. Frontal carinae extending to anterior border of eyes. Eyes large and convex, situated at middle of sides. Ocelli large and prominent. Thorax barely twice as long as broad, sutures very feeble. Pronotum almost twice as long as broad, strongly convex and margined on the sides. Mesonotum greatly constricted laterally, one-fifth broader than long, sides not margined. Epinotum slightly broader than pronotum, strongly margined on sides and posterior border, the latter straight. In profile convex longitudinally, declivity short, almost straight, sides margined. Node one-fourth broader than long, broader behind than in front, broadest at middle, strongly margined on sides, terminated behind by a long, moderately broad process, directed outward and curved inward; in profile longer than high, the anterior face short and vertical, sides margined, dorsum convex, the angles behind almost horizontal, no tooth-like process below on ventral surface. Postpetiole almost one-fourth broader than long, broadest behind, sides convex, margined on the anterior third, anterior border straight, margined, the angles bluntly produced laterally. A deep and wide constriction between postpetiole and first segment of gaster, the latter almost one-third broader than long and one-fourth broader behind than in front. Pygidium feebly concave, submarginate. Legs robust, posterior coxae with a rather pointed, translucent laminae on top behind.

Habitat.—Minnie Downs, N.E. corner of S. Australia (L. Reese).

Type in South Australian Museum.

Phyracaces greavesi, sp. nov.

(Pl. II, fig. 5.)

Worker.—Length, 5.5 mm.

Bright castaneous; margins of thorax and node black; antennae and legs more yellowish.

Smooth and shining. Microscopically reticulate. Mandibles punctate.

Hair yellow, long and erect, moderately abundant. Pubescence not apparent.

Head very slightly longer than broad, sides convex, occipital border straight, or very feebly convex. Mandibles triangular, terminal border denticulate. Clypeus short, broadly rounded in front. Frontal carinae truncate and confluent behind. Carinae of cheeks strong, extending to the anterior fourth of eyes, a small branch, about midway, directed inward to antennal fovea. Scapes slightly exceeding the posterior margin of the eyes; first segment of funiculus as long as second, longer than broad, third to ninth broader than long, tenth as long as broad, apical fully twice as long as broad and longer than the two preceding together. Eyes large, convex, situated at the middle of sides. Ocelli large and prominent. Thorax one and three-quarters times longer than broad, constricted at the middle, sutures not indicated; sides strongly and continuously marginate; anterior border submarginate in the middle, stronger near angles which are sharp but hardly projecting; posterior border straight, slightly indented at the middle, strongly marginate, angles sharp. In profile convex longitudinally, declivity short, concave, marginate on sides, superior border slightly reflexed. Node one-third broader than long, broadest at middle, sides convex, strongly marginate, anterior border concave, feebly marginate, angles sharp, posterior border straight, the angles produced behind as short blunt teeth, directed upward; in profile as high as long, anterior face feebly convex, angle blunt, dorsum feebly convex, posterior face vertical, as high as anterior face; ventral surface convex with a feeble tooth in front. Postpetiole about one-fourth broader than long, sides convex, anterior border straight, angles rounded, border marginate, extending round to the anterior third of sides. Constriction between postpetiole and gaster wide. First segment almost one-third broader than long. Pygidium flat, submarginate and furnished with a row of strong sharp bristles. Legs robust. Posterior coxae without a lamina.

Habitat.—Western Australia: Bungulla (T. Greaves).

Similar to *P. newmani* Clark in size and colour but readily separated by the ocelli.

Phyracaces aberrans, sp. nov.

(Pl. II, fig. 6.)

Worker.—Length, 6 mm.

Black; mandibles, scapes, apex of funiculus, tarsi and pygidium red; middle of funiculus, tibia and femora, brown.

Smooth and shining, with moderately large, piligerous punctures, abundant throughout.

Hair white, long, suberect, most abundant on apical segments of gaster. Pubescence white, fine, sparse throughout.

Head as long as broad, sides and occipital border feebly convex, angles rounded. Mandibles broad, edentate. Clypeus very short. Frontal carinae converging behind. Scapes extending to near posterior margin of eyes; first segment of funiculus as long as broad, second to tenth broader than long, apical barely twice as long as broad and fully as long as the two preceding together. Eyes large, circular, rather flat, situated at middle of sides. No ocelli. Thorax one and three-quarters times longer than broad, without traces of sutures, feebly compressed at the mesonotal region, borders bluntly rounded; in profile feebly convex longitudinally, the declivity short, at an oblique angle, rounded into dorsum above. Node one-fourth broader than long, broader behind than in front, sides convex and feebly marginate, anterior border concave, angles sharp, posterior angles produced as short, broad teeth; in profile longer than high, anterior face vertical, dorsum strongly convex, strong sharp hook-shaped tooth in front below, directed backward. Postpetiole very slightly broader than node, slightly broader than long, sides convex; a deep, but not wide, constriction between the postpetiole and first segment of gaster, the latter one-fourth broader than long. Pygidium concave, sides submarginate and bearing a row of short sharp bristles. Legs robust.

Habitat.—N. Queensland: Kuranda (F. P. Dodd).

Type in South Australian Museum.

Readily distinguished from all the known species by the lack of margins to thorax.

Phyracaces pygmaeus, sp. nov.

(Pl. II, fig. 7.)

Worker.—Length, 2.8-3 mm.

Head brown, gaster black; pronotum and node ferruginous; meso-epinotum and postpetiole castaneous; antennae and legs ochraceous.

Smooth and shining, with large, scattered, shallow piligerous punctures, abundant throughout.

Hair yellow, long and suberect, abundant throughout. Pubescence hardly apparent, very fine and adpressed.

Head slightly longer than broad, sides feebly convex, occipital border almost straight. Mandibles edentate, with sharp cutting borders. Frontal carinae narrow and parallel, truncate and approximate behind; carinae of cheeks strong, extending to anterior third of eyes. Scapes extending slightly beyond posterior margin of eyes, gradually thickened to apex; first segment of funiculus barely as long as broad, second to seventh almost twice as broad as long, eighth one and a half times broader than long, ninth and tenth slightly broader than long, apical twice as long as broad and as long as the three preceding together. Eyes large and rather flat, almost one-third the length of sides, situated in front of the middle. No ocelli. Thorax one and three-quarters times longer than broad, sutures faintly indicated, feebly constricted at the mesonotal region. Anterior border of pronotum convex and marginate, angles rounded, posterior border of epinotum straight and marginate, angles sharp; sides of thorax rounded, not marginate. In profile evenly arched longitudinally, declivity flat, at an oblique angle, sides submarginate. Node

one and three-quarters times broader than long, broader behind, sides convex, strongly marginate, anterior and posterior borders concave, former marginate, all four angles sharp. In profile higher than long, anterior face vertical, the sides marginate, superior angle sharp, dorsum convex; the ventral surface in front ending in a tooth-like projection. Postpetiole one and three-quarters broader than long, sides strongly convex, anterior border almost straight. A deep and wide constriction between postpetiole and gaster, first segment one-fourth broader than long. Pygidium flat. Legs slender, posterior coxae with a small translucent lamina on top behind.

Habitat.—N. Queensland: Kuranda (F. P. Dodd).

Nearest to *P. elegans* Wheeler but readily separated by the formation of the thorax and nodes.

Subfamily **Ponerinae** Lepeletier 1836.

Genus AMBLYOPONE Erichson 1842.

Subgenus FULAKORA Mann 1919.

Dr. Wheeler in dealing with the genus *Amblyopone* (Proc. Amer. Acad. Arts and Sci., 62 (1), pp. 1, 2, 1927) noted that *Stigmatomma, Fulakora* and *Xymmer* were probably attachable to *Amblyopone*. The additional material which has been secured since that time warrants the adoption of Wheeler's suggestion. All three are here regarded as subgenera of *Amblyopone*. To the subgenus *Fulakora* is referred the additional species *A. exigua* Clark, and *A. wilsoni* Clark.

Amblyopone (*Fulakora*) *lucida*, sp. nov.

(Pl. II, fig. 8.)

Worker.—Length, 4–4.5 mm.

Russet; legs testaceous.

Head reticulate-punctate; mandibles longitudinally and finely striate; thorax, node and gaster finely punctate, smooth and shining.

Hair yellow, short and erect, sparse except on antennae, legs and apical segments of gaster. Pubescence yellow, fine and adpressed, abundant throughout.

Head slightly longer than broad, slightly broader in front than behind, sides feebly convex, occipital border straight, angles strongly rounded. Mandibles long and narrow, external border feebly concave, inner border feebly convex, furnished with eight strong sharp teeth, the apex long and sharp. Clypeus convex in front the border furnished with ten sharp teeth, almost as strong on those on mandibles. Frontal carinae approximate, erect, short, truncate and slightly diverging behind, overhanging but not quite hiding the antennal insertions. Scapes short, extending a little beyond middle of head; first segment of funiculus as long as the three following, apical segment as long as the two preceding together. Eyes minute, composed of from one to three facets, situated at the posterior third of head. Ocelli absent. Thorax almost two and one-quarter times longer than broad. Pro-mesonotal suture deeply impressed; meso-epinotal suture indicated. Pronotum as broad as

long, strongly convex on sides and in front. Mesonotum one-third broader than long. Epinotum as broad as long, slightly broader behind than in front. In profile dorsum straight, declivity abrupt, its superior edge rounded into dorsum. Node one-fifth broader than long, strongly convex in front and on sides, separated by a wide constriction from the postpetiole ; in profile longer than high, the anterior face vertical, rounded into dorsum which is slightly convex ; there is a broad plate-like projection below in front, half the length of ventral surface, much longer than high. Postpetiole broader than long and broader behind than in front, sides convex ; a deep constriction between it and first segment of gaster, the latter slender, hardly wider than postpetiole. Legs moderately robust.

Habitat.—Federal Capital Territory ; Corrie Creek (G. F. Hill, 20–7–30).

Amblyopone (Fulakora) punctulata, sp. nov.

(Pl. II, fig. 9–10.)

Worker.—Length, 3–3.5 mm.

Castaneous ; mandibles, antennae and legs more yellowish.

Head finely reticulate, mandibles finely striate longitudinally. Thorax and node densely and finely punctate.

Hair yellow, short and erect, moderately abundant, not shorter on antennae and legs. Pubescence yellow, very fine and short ; adpressed, moderately abundant throughout.

Head one-sixth longer than broad, broader in front than behind, sides very feebly convex, occipital border straight or feebly concave, angles rounded. Mandibles broad at middle, furnished with six to seven stout, laterally bifid teeth. Clypeus strongly convex in front, furnished with eight short sharp teeth. Frontal carinae erect, approximate, short. Scapes extend to middle of head, first segment of funiculus longer than two following together, others broader than long to apical which is as long as the three preceding together. Eyes minute, three or four facets, placed at posterior third of head. Thorax twice as long as broad. Pronotum as long as broad, front and sides strongly convex, dorsum feebly convex. Mesonotum twice as broad as long, oval, sutures deeply impressed. Epinotum as broad as long, sides convex. In profile pronotum truncate and convex in front, feebly convex behind. Mesonotum and epinotum straight, declivity straight, at an oblique angle, rounded into dorsum. Node as broad as long, front and sides strongly convex ; in profile as high as long, anterior face straight, forming a right angle with dorsum into which it is rounded ; a long broad projection in front below directed backward, somewhat hook-shaped. Postpetiole one-fourth broader than long, sides strongly convex. Gaster slender. Legs short.

Female.—Length, 3.5–4.3 mm. (Ergatoid).

Colour, sculpture and pilosity as in the worker.

Head longer than broad, sides almost parallel, feebly convex, occipital border straight or feebly concave, the angles strongly rounded. Mandibles rather broad at the middle, external border convex at base and apex, straight at middle : inner border strongly convex, furnished with seven broad laterally bifid teeth. Clypeus convex in front, the anterior border furnished with eight short sharp teeth, the central pair joined at the base. Frontal carinae approximate, short, truncate and diverging behind. Scapes extending to posterior

margin of the eyes; first segment of funiculus longer than two following together, apical as long as three preceding together. Eyes circular, small, flat, placed at the posterior third of head. Ocelli minute. Thorax fully twice as long as broad. Pronotum as broad as long, strongly convex on the sides and in front. Mesonotum broader than long, the sutures well impressed. Epinotum as broad as long, sides parallel. In profile feebly convex longitudinally, the declivity almost as long as dorsum of epinotum, the boundary between them bluntly rounded. Node almost one-fourth broader than long, broader behind than in front, strongly convex in front and on sides; in profile as high as long, the anterior face vertical, bluntly rounded into dorsum, the latter slightly convex; a long, broad, projection in front below, with the anterior corner broadly rounded. Postpetiole almost one-third broader than long. A deep constriction between it and first segment of gaster, the latter broader than long. Legs short and stout.

Habitat.—Tasmania: Trevallyn (V. V. Hickman).

The female has been described in detail owing to the remarkable resemblance to the worker. It can only be distinguished by the slightly larger size, and possessing larger eyes and ocelli. All the known females of *Amblyopone* and *Fulakora* are winged. It is possible that the form described is not the true female, but with the exception of the thoracic segments it corresponds well with known females in the group.

Genus DISCOTHYREA Roger 1863.

Discothyrea leae, sp. nov.

(Pl. II, fig. 11.)

Female.—Length, 2.6 mm. approximately.

Castaneous throughout. Pilosity yellowish, short and suberect, rather abundant, particularly on gaster. Pubescence very fine, short and adpressed.

Head, thorax, and node subopaque, finely and densely punctate, the epinotal declivity shining and finely punctate. Gaster shining, densely punctate, the punctures larger and more scattered than on thorax. Antennae and legs finely and densely punctate.

Head very slightly longer than broad, almost circular, the sides and occipital border strongly convex. Mandibles triangular, furnished with strong sharp teeth, the apex long and pointed. Clypeus short and truncate. Front of head projecting, overhanging the clypeus and mandibles. Frontal carinae short and erect, extending from front of frontal projection to near middle of eyes, swerving outward at middle then inward and approximate behind. Scapes short, greatly thickened to apex, their insertions exposed, extending a trifle beyond the posterior margin of eyes; first segment of funiculus as long as the two following, apical twice as long as broad and as long as the six preceding together, these are broader than long. Eyes large, moderately convex, circular, placed at middle of sides. Ocelli large and convex. Thorax one and a half times longer than broad. Pronotum truncate in front, just visible from above. Mesonotum as long as broad behind, parapsidal furrows faintly indicated. Scutellum broader than long, convex behind. Epinotum

short and broad, strongly concave at the middle. In profile dorsum of mesonotum and scutellum flat, latter truncate behind, metanotum level with posterior of scutellum, declivity vertical, posterior corner projecting slightly giving a concave appearance. Node twice as broad as long, the anterior and posterior faces straight, broader behind than in front; in profile twice as high as long, anterior face convex and rounded into dorsum, posterior face flat or feebly concave, superior border sharp. Postpetiole one-fifth broader than long, no constriction between it and gaster, the latter turned down with the terminal segments underneath. Legs robust.

Habitat. S. Australia: Mt. Lofty (A. M. Lea.)

Type in South Australian Museum.

Genus EUPONERA Forel 1891.

Subgenus BRACHYPONERA Emery 1901.

Euponera (Brachyponera) rufonigra, sp. nov.

(Pl. II, fig. 12–13.)

Worker. Length, 5 mm.

Black; mandibles, frontal carinae, antennae, legs and apex of gaster ferruginous; in some examples the scapes and femora darker.

Subopaque. Mandibles coarsely punctate. Head and thorax finely and densely punctate, some examples almostly finely reticulate; gaster also densely punctate but more widely spread. Antennae and legs very finely and densely punctate.

Hair yellow, fine, suberect, abundant but short throughout except on apical segments of gaster. Pubescence greyish, rather long, adpressed, abundant throughout but not hiding the sculpture.

Head very slightly longer than broad, slightly broader behind than in front, sides convex, occipital border straight, angles rounded. Mandibles almost half as long as head, triangular, with teh to twelve strong sharp teeth. Clypeus very short, produced and convex in front, strongly carinate above, apex produced tooth-like on anterior border. Frontal carinae lobe-like, approximate, longer than broad. Scapes extending beyond occipital border by their thickness; first segment of funiculus twice as long as broad, second to sixth slightly longer than broad, seventh to tenth as broad as long, apical twice as long as broad, as long as the two preceding together. Eyes small, flat, placed at twice their diameter from anterior border. Thorax one and two-thirds longer than broad; pro-mesonotal suture sharply impressed, meso-epinotal suture indistinct. Pronotum one-third broader than long, strongly convex. Mesonotum almost one-fourth broader than long, convex. Epinotum one-third longer than broad. In profile feebly convex longitudinally, pronotum descending abruptly in front; declivity abrupt, rounded into dorsum, one-fourth longer than latter. Node almost three times longer than broad, strongly convex in front, flat behind, dorsum convex laterally; in profile almost twice as high as long at base, anterior face straight, vertical, posterior slightly convex, inclined forward; a long broad process in front below, with a sharp tooth directed behind. Postpetiole one-fourth broader than long, front and sides

convex, a feeble constriction between it and first segment of gaster, latter one-fourth broader than long, strongly convex on sides. Legs slender.

Female.—Length, 6.5 mm.

Colour, sculpture and pilosity as in the worker, differing only in the following details.

Head as broad as long, occipital border feebly concave. Eyes much larger. Ocelli large. Pronotum two and one-fourth times broader than long. Mesonotum broader than long, feebly convex above, parapsidal furrows sharply impressed. Scutellum twice as long as broad, oval. Node similar to worker but more slender. Wings missing.

Habitat.—W. Australia : Perth, Armadale, Mundaring, Busselton, Albany.

Genus ECTOMOMYRMEX Mayr 1867.

Ectomomyrmex ruficornis, sp. nov.

(Pl. II, fig. 14.)

Worker.—Length, 5.5 mm.

Black ; mandibles, antennae, tibia, tarsi, anterior half of frontal carinae and apex of gaster castaneous ; femora and coxae brownish.

Opaque, mandibles shining, somewhat coarsely punctate, striate longitudinally. Head and thorax densely and coarsely reticulate, in parts almost punctate. Epinotal declivity strongly and sharply striate transversely, continued longitudinally on sides of epinotum. Node transversely arched striate-rugose on top. Antennae, legs and gaster finely and densely punctate. Coxae feebly reticulate transversely.

Hair yellow, fine, long and suberect, moderately abundant throughout, more so at apex of gaster. Pubescence yellow, fine and adpressed, abundant, but by no means hiding the sculpture.

Head slightly longer than broad, broader behind than in front, sides feebly convex, occipital border truncate, straight, or feebly concave in middle. Mandibles subtriangular, apex long and sharp, furnished with four large sharp teeth, with a small one between each. Clypeus short, produced and bluntly pointed in front, with a fine sharp carina which extends from apex to between frontal carinae. Frontal carinae approximate, as long as broad, lobe-like in front but not hiding the antennal insertions, a weak frontal groove between them extending back to middle of head. Scapes barely reaching occipital border ; funiculus thickened towards apex, first segment as long as two following together, second to tenth broader than long, apical bluntly pointed, as long as the three preceding together. Eyes small, flat, with about seven facets, placed twice their diameter from the front edge. Thorax fully one and three-quarter times longer than broad, almost twice as broad through pronotum as through epinotum. Pronotum one-third broader than long, strongly convex, pro-mesonotal suture sharply, meso-epinotal suture weakly, defined, dorsum of meso-epinotum convex laterally, posterior border concave, sharply margined. In profile the pronotum feebly convex, meso-epinotum straight, declivity at an oblique angle, straight or feebly convex, edges sharply margined, inferior edges of pronotum and prosternum sharply margined. Node two and a half times

broader than long, sides and anterior face united in a hemi-circle, posterior border concave, in profile higher than long, anterior face straight, posterior face strongly convex, rounded into dorsum. Postpetiole one-fourth broader than long, anterior face straight, truncate, sides feebly convex. First segment of gaster one-fourth broader than long, as broad as behind, feebly convex. Legs short and robust.

Habitat.—N. Queensland: Cairns (Dr. W. M. Wheeler, 13-10-14).

Apparently near *E. astuta* Smith, the only other species in this genus recorded from Australia, but smaller and differently sculptured. Described from a specimen received from Dr. Wheeler.

Genus EUBOTHROPONERA Clark 1930.

Eubothroponera tasmaniensis (Forel).

(Pl. II, fig. 15.)

Pachycondyla (*Bothroponera*) *tasmaniensis* Forel, Bull. Soc. Vaud. Sc. Nat. xlix, p. 176, 1913, ♀.

Bothroponera tasmaniensis, Clark, Proc. Roy. Soc. Vic. xliii (i), p. 11, 1930, ♀.

Worker.—Length, 5.6 mm.

Head, dorsum of thorax and gaster brownish black; mandibles, sides of thorax and node ferruginous; antennae and legs castaneous.

Opaque. Mandibles, antennae and legs very finely and densely punctate. Head, thorax and gaster finely and densely reticulate, node more coarsely so and more shining.

Hair yellow, short and suberect, moderately abundant throughout except on antennae and legs. Pubescence yellowish, fine and rather dense throughout but by no means hiding the sculpture.

Head almost one-fourth longer than broad, slightly broader behind than in front, sides feebly convex, occipital border straight. Mandibles triangular, edentate, apex long and slender. Clypeus broadly rounded in front, raised abruptly level with top of frontal carinae; latter flattened, lobe-like, overhanging but not hiding the antennal insertions, not as long as wide in front. Frontal groove short. Scapes extending beyond occipital border by fully their thickness; first segment of funiculus longer than second and third, fourth to tenth as long as broad, apical twice as long as broad. Eyes convex, placed at middle of sides. Thorax one and three-quarters times longer than broad. Pronotum one-third broader than long, sides and front convex, suture sharply defined. Meso-epinotal suture weakly defined. Posterior margin of epinotum feebly concave. In profile convex longitudinally, declivity abrupt and straight, sides feebly margined. Node almost one and one-half times broader than long, sides and anterior border convex, posterior border straight, dorsum flat with a strong central longitudinal carina; in profile one and one-fourth times higher than long, anterior and posterior faces straight, ventral surface convex, with a short blunt tooth behind directed backward. Postpetiole one and two-thirds broader than long, strongly convex in front and

on sides ; a slight constriction between postpetiole and first segment of gaster, the latter broader than long, as broad in front as behind, sides strongly convex. Legs long and slender.

Habitat.—Tasmania : Hobart (A. M. Lea).

Redescribed from a single example, one of the type series, recently received from Dr. W. M. Wheeler.

This species should be regarded as the genotype in place of *E. dentinodis* Clark.

Eubothroponera reticulata, sp. nov.

(Pl. II, fig. 16.)

Worker.—Length, 4.8 mm.

Head and thorax chocolate brown ; base of gaster black ; apex and node ferruginous ; mandibles, antennae and legs castaneous.

Opaque. Mandibles finely and densely punctate. Head and thorax finely and densely reticulate and with numerous large, shallow punctures. Node more coarsely punctate-reticulate. Gaster finely and densely punctate. Antennae and legs microscopically punctate.

Hairs yellow, short and erect, moderately abundant throughout. Pubescence yellow, very fine and adpressed, abundant throughout.

Head one-fifth longer than broad, sides convex, occipital border straight or feebly convex. Mandibles triangular, edentate, apex sharp. Clypeus produced and convex in front, short and abruptly raised to level of frontal carinae, the latter lobe-like, slightly raised outwardly, almost hiding the antennal insertions. Scapes extending beyond occipital border by fully their thickness : first segment of funiculus longer than second, second and third longer than broad, fourth to tenth as broad as long, apical barely twice as long as broad. Eyes large and convex, placed at middle of sides. Thorax barely twice as long as broad ; pro-mesonotal suture sharply defined, meso-epinotal suture not indicated. Pronotum barely one-third broader longer than broad, sides feebly convex. Posterior border of epinotum concave and feebly margined ; in profile strongly convex longitudinally, pro-mesonotal suture strongly indented, declivity straight, sides sharply margined. Node one-third broader than long, broader behind than in front, sides and anterior border straight or feebly convex, angles rounded, posterior border straight with a short broad sharp tooth in middle projecting backward, dorsum feebly convex, with faint indications of a central carina ; in profile one-fourth higher than long, anterior face straight and rounded into dorsum which is higher behind, posterior face straight, ventral surface convex with a short blunt tooth behind directed backward. Postpetiole one and one-half times broader than long, sides and anterior border feebly convex. A strong constriction between gaster and postpetiole. First segment of gaster as long as broad, sides convex. Legs long and slender.

Habitat.—N.S. Wales : Sutherland (Dr. W. M. Wheeler, Sept. 16, 1914).

Near *E. dentinodis* Clark.

Eubothroponera septentrionalis, sp. nov.

(Pl. II, fig. 17.)

Worker.—Length, 5.6 mm.

Chocolate brown; gaster black; node blood red; antennae and legs reddish yellow, darker towards apex of scapes, femora, and tibiae.

Head, thorax and postpetiole densely and finely rugose, node more coarsely so, gaster finely and densely punctate.

Hairs reddish, short and erect, moderately abundant throughout. Pubescence very short, fine and adpressed.

Head one-seventh longer than broad, as broad in front as behind, broadest at eyes, sides and occipital border convex. Mandibles triangular, external border almost straight, terminal border concave, indistinctly dentate, apex long and sharp, angle between the terminal and inner borders rounded. Clypeus broadly rounded in front, rising abruptly level with top of frontal carinae, the latter flat above, rather broad, hardly continued beyond the lobes, these overhanging the antennal insertions. Scapes extend beyond occipital border by one and a half times their thickness: first segment of funiculus barely as long as second, the others subequal to apical which is as long as the two preceding together. Eyes large and convex, their posterior margin at middle of head. Thorax barely twice as long as broad. Pronotum one and a half times broader than long, suture deeply impressed. Mesonotum and epinotum united without traces of a suture; in profile feebly convex longitudinally, the declivity short, rounded into dorsum, sides and top feebly margined. Node one-third broader than long, anterior face and sides strongly convex, posterior face concave, the superior edge sharply marginate with a sharp tooth-like projection in the middle, this tooth being the terminal of an obsolete carina on dorsum. In profile higher than long, the anterior face vertical, feebly convex, rounded into dorsum, latter feebly convex; a short sharp tooth behind, at posterior fourth, directed backward. Postpetiole one-third broader than long, convex in front and on sides. A strong constriction between postpetiole and gaster, the latter slightly broader than long, sides strongly convex. Legs long and slender.

Habitat.—Queensland: Townsville (F. P. Dodd, 15–11–02).

Type in the Queensland Museum.

Near *E. dentinodis* Clark but readily separated by the colour, sculpture and shape of head.

Genus LEPTOGENYS Roger 1861.

Subgenus LOBOPELTA Mayr 1862.

Leptogenys (*Lobopelta*) *angustinoda*, sp. nov.

(Pl. II, fig. 18–19.)

Worker.—Length, 8 mm.

Black; mandibles, funiculus, tibiae and tarsi castaneous, scapes and femora darker.

Shining. Head and body with sparse, scattered, shallow piligerous punctures. Antennae and legs with finer and more abundant punctures.

Hair yellow, fine and suberect, very sparse throughout. Pubescence yellowish, very fine and adpressed, apparent only on antennae and legs.

Head one-fourth longer than broad, sides feebly convex, almost parallel, occipital border straight, angles strongly rounded. Mandibles almost half as long as head, narrow, gradually widening to the apex, terminal border short, furnished with two large sharp teeth and four or five more or less obsolete teeth, the first large one midway between apex of mandible and the second, the latter almost at centre of border; an obsolete tooth between these large ones. Clypeus greatly produced and bluntly rounded in front, a strong carina on top extending on to frontal carinae, this carina in part grooved longitudinally. Frontal carinae narrow, extending back to middle of eyes. Scapes extending beyond occipital border by twice their thickness; first segment of funiculus very slightly longer than second, the latter one and a half times longer than third, fourth longer than broad, the remainder as broad as long to the apical which is as long as the two preceding together. Eyes large, rather flat, placed at middle of sides. Thorax fully twice as long as broad. Pronotum almost one-fourth broader than long, sides and front convex. Mesonotum transverse, four times broader than long, both sutures feebly impressed. Epinotum narrow and convex laterally. In profile convex longitudinally, the declivity and dorsum of epinotum merged and convex. Node almost twice as long as broad behind, and twice as broad behind as in front, sides straight or feebly concave; in profile slightly longer than high, one-third higher behind than in front, anterior face short and vertical, dorsum strongly convex, posterior face vertical, superior border rounded. Postpetiole bell-shaped, one-fourth broader than long, strongly convex; a wide constriction between it and first segment of gaster, the latter almost twice as broad as long. Legs long and slender.

Female.—Length, 8.5 mm.

Colour, sculpture and pilosity as in the worker. Sides and occipital border more convex. Eyes slightly larger. Ocelli well developed. Mesonotum much larger. Scutellum and metanotum present but small. Node shorter and broader. Gaster much larger.

Habitat.—N.S. Wales: Armidale (C. F. Deuquet).

Leptogenys (*Lobopelta*) *hackeri*, sp. nov.

(Pl. II, fig. 20.)

Worker.—Length, 10 mm.

Head, thorax and node blue; gaster black with a brownish tinge; mandibles, clypeus, antennae and legs castaneous.

Mandibles shining, finely striate longitudinally and with scattered shallow punctures. Head and thorax finely rugose. Node finely and irregularly striate-rugose. Gaster smooth and shining with scattered piligerous punctures.

Hair yellow, moderately long, suberect, abundant throughout, shorter and more adpressed on antennae and legs. Pubescence yellow, very short and adpressed on antennae and legs, not apparent on body.

Head one-third longer than broad, broader in front than behind, sides convex, occipital border straight, sharply margined, angles bluntly rounded.

Mandibles fully half the length of head, broader near apex than at base, terminal border short, edentate. Clypeus greatly produced and bluntly pointed in front, a strong central carina above extending from apex to between frontal carinae, the latter approximate, parallel, not hiding the antennal insertions in front. Scapes extending beyond occipital border by fully one-third of their length; second segment of funiculus one-third longer than first, the others subequal to apical which is as long as second. Eyes large, moderately convex, placed at middle of sides. No ocelli. Thorax fully two and a half times longer than broad, strongly convex in front and on the sides. Pronotum one-fourth broader than long. Mesonotum almost twice as broad as long, sutures well defined. Epinotum longer than broad, narrow above, almost ridged in front. In profile convex longitudinally, the meso-epinotal suture deep and wide, declivity short and abrupt, rounded into dorsum. Node fully one-third longer than broad and twice as broad behind as in front, sides straight, anterior and posterior borders convex: in profile as high as long, higher behind than in front, the anterior and posterior faces vertical for half their height, then broadly rounded into dorsum, giving a somewhat dome-shaped appearance; a long sharp tooth-like process in front below directed backward. Postpetiole bell-shaped, slightly longer than broad, strongly convex; a deep constriction between it and first segment of gaster, the latter broader than long. Legs long and slender.

Habitat.—N.S.Wales: Cascade (F. E. Wilson). Queensland: National Park (H. Hacker, Dec., 1919).

Subfamily **Myrmicinae** Lepeletier 1836.

Genus PODOMYRMA Smith 1858.

Podomyrma tricolor, sp. nov.

(Pl. II, fig. 1.)

Worker.—Length, 11–13 mm.

Head ferruginous; antennae, thorax, nodes, legs, apex of first and the whole of three apical segments of gaster chocolate brown; first segment of gaster yellow; teeth of mandibles black.

Mandibles finely striate, head, including clypeus, strongly and somewhat coarsely striate longitudinally. Pronotum transversely striate, mesonotum, epinotum, sides of thorax, and postpetiole longitudinally striate, coarser than on head, declivity and top of node smooth and shining, sides of node longitudinally striate. Gaster smooth and shining, with fine short longitudinal striae at base, not reaching to anterior fourth of segment.

Hair yellowish, long and erect, moderately abundant, shorter on antennae and legs. Pubescence confined to apex of antennae.

Head slightly longer than broad, very slightly broader behind than in front, sides straight, occipital border convex, angles rounded. Mandibles furnished with seven strong sharp teeth. Clypeus short. Anterior border straight or feebly concave. Frontal area large, triangular. Frontal carinae rather flat, slightly longer than broad in front. Scapes not reaching the occipital border by one-third their length; first to seventh segments of

funiculus longer than broad, eighth and ninth as broad as long, apical as long as the two preceding together. Eyes convex, projecting slightly from sides, placed behind middle. Thorax one and three-fourths times longer than broad, sutures not impressed. Pronotum two and two-thirds times broader than long, strongly convex and margined in front, angles produced as long broad spines directed outward laterally and very slightly forward, longer than their width at base, sides convex, not margined. Mesonotum slightly longer than broad, bluntly pointed in front, convex behind, a short, broad, sharp tubercle at centre of anterior border, vertical, hardly noticed from above ; this tubercle is the termination of the three central carinae. A deep and wide constriction between epinotum and mesonotum but without margins on either. Epinotum twice as long as broad on top, spiracles prominent and tubercle-like almost on dorsum near middle of sides. Posterior border convex, furnished with two short sharp spines, slightly longer than the distance apart at their base, directed slightly outward and backward. In profile pronotum and mesonotum strongly convex, anterior border sharp and projecting. Anterior spines directed forward, tubercle on dorsum short and sharp. Meso-epinotal constriction deep and wide, concave. Epinotum feebly convex, one-fourth longer than declivity, latter oblique, feebly convex, spines on superior angles erect, directed very slightly backward. Node one and one-half times longer than broad, sides almost parallel, produced to a blunt point above ; in profile longer than high, convex from the anterior fourth, a short sharp spine near middle, ventral surface concave, a long blunt parallel tooth in front directed forward. Post-petiole broader than long, oval ; in profile higher behind than in front. Gaster almost one-third longer than broad, first segment covering three-fourths of the area. Legs long and robust, femora greatly thickened.

Habitat.—North Queensland : Claudie River (J. A. Kershaw).

The large size, peculiar colour and sculpture readily distinguish this from all previously described forms.

Genus DACRYON Forel 1895.

Dacryon ferruginea, sp. nov.

(Pl. III, fig. 2.)

Worker.—Length, 4–5 mm.

Ferruginous ; legs and gaster a little more yellowish.

Mandibles shining, coarsely striate, with large scattered punctures. Head, thorax and nodes coarsely striate longitudinally, very finely and densely punctate between striae ; on occipital border the head is more rugose. Antennae and legs much more finely punctate. Some very fine longitudinal striae on anterior fourth of gaster.

Hair yellow, erect, rather thick, moderately abundant throughout, shorter on antennae, none on legs. Pubescence very fine and short, conspicuous only on antennae and legs.

Head slightly longer than broad, sides feebly convex, occipital border straight or feebly concave, angles rounded. Mandibles furnished with four strong sharp teeth behind apex. Clypeus convex in front with a slight concave excision at centre. Frontal area triangular. Frontal carinae extending

almost to occipital border, giving the appearance of antennal grooves at each side of head. Scapes not extending to occipital border by fully their thickness; first segment of funiculus longer than the two following together, second to seventh at least as broad as long, eighth and ninth longer than broad, apical longer than two preceding together. Eyes large, convex, projecting slightly at sides. Thorax almost twice as long as broad, sutures feebly indicated. Pronotum convex, bluntly produced, in front, marginate, the margin continued on sides, anterior angles sharply produced, but not spined; dorsum almost flat, feebly convex. Mesonotum broader than long with a short stumpy tubercle at each side; strongly constricted laterally and on dorsum, between mesonotum and epinotum. Epinotum one one-fourth longer than broad, sides convex and submarginate, posterior border with two long spines directed outward and backward, almost as long as the distance apart at base. In profile pronotum truncate in front, anterior angle sharp, marginate, inferior angle sharp. Mesonotum forming a single convexity with pronotum. Epinotum convex, almost twice as long as declivity, latter convex, spines rather thick, directed backward and upward. Node about one-fourth longer than broad dorsum produced in front and sides to sharp angles which each bear a sharp spine directed upward; in profile longer than high, anterior face almost vertical, convex, terminating above in a short sharp spine, dorsum straight, dropping behind, the lateral spine longer and stronger than anterior spine, placed at middle of side; ventral surface concave, with a long broad tooth in front directed forward. Postpetiole one and one-half times broader than long, oval; in profile convex above. Gaster about one and one-half times longer than broad. Legs short and robust, femora towards base.

Habitat.—N.S. Wales: Bombala (W. W. Froggatt). Federal Capital Territory: Canberra (T. Greaves).

Genus LORDOMYRMA Emery 1897.

Lordomyrma rugosa, sp. nov.

(Pl. III, fig. 3–4.)

Worker.—Length, 3.5 mm.

Castaneous; legs and gaster yellow.

Mandibles smooth and shining, with large scattered shallow punctures. Head, thorax and nodes longitudinally striate-rugose, the interstices smooth and shining; legs and gaster smooth and shining.

Hair yellow, long and erect, abundant, shorter on antennae and legs. Pubescence very fine and adpressed, apparent only on antennae and legs.

Head slightly longer than broad, sides convex, occipital border almost straight, feebly convex, angles rounded. Mandibles furnished with four strong sharp teeth behind apex. Clypeus short, bicarinate, space between carinae concave. Frontal area triangular, feebly impressed. Frontal carinae extending almost to occipital border, forming inner boundary of antennal foveae. Scapes abruptly bent at base, not extending to occipital border by their thickness; first segment of funiculus longer than two following together, second to seventh broader than long, eighth and ninth as broad as long, apical longer than the two preceding together. Eyes convex, projecting slightly at sides, placed slightly in front of middle. Thorax one and two-thirds times

broader than long. Sides and anterior border of pronotum convex, anterior angles bluntly rounded, a short sharp tooth at each side of mesonotum, directed outward. In profile anterior edge and sides of pronotum submarginate, angles blunt and submarginate downward midway to inferior angle, latter bluntly rounded. Mesonotal spine short, directed upward. Epinotum convex, rounded into declivity, spines long and sharp, directed upward and backward. Node almost twice as long as petiole, as long as broad, with a long sharp spine on each side in front, and indication of a spine at centre of front ; in profile the anterior face at an oblique angle, convex, with a sharp spine at each side, longer than thick at base, directed backward, dorsum inclined backward, straight ; ventral surface concave, with indications of a tubercle in front. Postpetiole broader than long, oval, in profile evenly convex above. Gaster slightly longer than broad, oval. Legs robust, femora thickened near middle.

Female.—Length, 4.5 mm.

Colour, sculpture and pilosity similar to worker. Eyes larger. Ocelli prominent but placed in small pits. From above the pronotum broadly convex in front and sides, no trace of anterior angles. Mesonotum as long as broad. Scutellum as long as broad, circular. Spines on epinotum similar but further apart. In profile pronotum submarginate in front, concave below, convex above. Anterior superior angle feebly denoted, inferior angle bluntly rounded. Mesonotum convex above, without trace of spines. Scutellum convex above, overhanging metanotum and base of epinotum. Metanotum convex, narrow. Epinotum and declivity combined, convex, almost vertical, concave below, spines stout and sharp, as long as broad at base. Nodes, gaster and legs similar. Wings missing.

Habitat.—Victoria : Ferntree Gully (C. Barrett and J. Clark).

Readily separated from *L. punctiventris* Wheeler, the only other Australian species in the genus, by the colour as well as by the shape of the nodes.

Subfamily **Dolichoderinae** Forel 1878.

Genus BOTHRIOMYRMEX Emery 1865.

Bothriomyrmex wilsoni, sp. nov.

(Pl. III, fig. 5.)

Worker.—Length, 3.5 mm.

Brownish yellow ; mandibles, clypeus, antennae and legs lighter.

Shining, microscopically punctate throughout, larger on head than elsewhere. Clypeus smooth, mandibles very finely striate.

Hair yellow, short and erect, confined to mandibles, clypeus and apex of gaster. Pubescence yellow, very fine and adpressed.

Head slightly longer than broad, sides convex, occipital borders straight, angles rounded. Mandibles furnished with four strong sharp teeth, apex long and sharply pointed. Clypeus convex above, produced and convex in front. Frontal area elongate triangular. Frontal carinae diverging behind. Scapes

extending beyond occipital border by almost one-fourth their length; first segment of funiculus twice as long as second, third shortest, fourth to ninth almost twice as long as broad, apical longer than the two preceding together. Eyes large, circular, placed just behind middle of sides. Ocelli prominent. Thorax one-fifth longer than broad. Pronotum three times broader than long, sides and front strongly convex. Mesonotum one-third broader than long, much broader in front than behind, a slight excision on posterior border, a deep and wide depression between mesonotum and epinotum, spiracles placed on top at each side. Epinotum almost twice as broad as long, broader behind than in front, a short blunt tubercle at posterior angles. In profile pronotum strong convex. Mesonotum feebly convex, sutures well impressed. Epinotum dropping behind, declivity at an oblique angle, longer than dorsum, with a strong tubercle at superior angle. Node thin, scale-like hidden in a recess at front of gaster. The gaster very large, almost four times as long as thorax and fully one and one-third times longer than broad. Legs short and robust.

Habitat.—South Australia: Port Lincoln (F. E. Wilson, Oct. 1928.)

Three specimens taken in a nest of *Crematogaster laeviceps* Smith. This is not near any of the previously described Australian species. The voluminous gaster at once distinguishes it from all others.

It is with some doubt that this form is described as a worker, the large eyes and ocelli suggesting a female. The thorax however has no trace of wing sclerites, and is that of a worker.

Genus DOLICHODERUS Lund 1831.

Subgenus HYPOCLINEA Mayr 1855.

Dolichoderus (*Hypoclinea*) *doriae* Emery.

(Pl. III, fig. 6.)

Ann. Mus. Civ. Stor. Genova, 24, p. 252, ♀.

Gen. Insects, 137, p. 12, 1912, ♀.

Clark: Aust. Zool. vi, pt. iii, p. 254, 1920, ♀.

Female.—Length, 9.5 mm. (Ergatoid).

Black; mandibles, mesonotum and spines of epinotum chocolate brown; legs brownish red.

Mandibles finely striate near base, with scattered shallow punctures. Clypeus longitudinally striate at sides, smooth in middle. Head coarsely reticulate. Pronotum more coarsely and irregularly rugose; mesonotum coarsely reticulate-punctate. Epinotum smooth and shining, with coarse scattered punctures. Node finely rugose.

Hair yellowish, short and erect, sparse throughout. Pubescence yellow, confined to gaster, forming a dense covering but not hiding the sculpture.

Head as long as broad, almost circular. Mandibles furnished with twelve small teeth. Clypeus broad, convex above with a slight longitudinal depression extending to anterior border, latter strongly convex, with a slight concave indention at the middle. Frontal carinae diverging strongly behind, not covering the antennal insertions. Scapes extending beyond occipital border by one-fourth their length; first segment of funiculus one-third longer than second, second to fifth longer than broad, sixth to eleventh at least as broad as long, apical pointed, one-fourth longer than broad. Eyes small, circular, placed at middle of sides. The anterior ocellus only is present. Thorax one and three-fourths times long as broad. Pronotum twice as broad as long, broader in front than behind, the anterior angles produced forward as broad, short, blunt spines, as long as their width at base, dorsum convex laterally behind. Mesonotum circular, as long as broad, separated from epinotum by a deep and wide constriction, spiracles placed almost on dorsum. Posterior border with two long broad spines directed laterally, almost at right angles, their posterior margins slightly concave. In profile pronotum strongly convex, the spines short and blunt, directed forward. Suture deeply impressed. Mesonotum strongly convex. Meso-epinotal suture deep and wide. Epinotum feebly concave at the middle, rounded into declivity, both about same length, spines short and thick, directed very slight backward. Node three times broader than long, concave in front, convex behind and on sides; in profile very low, equal to half the height of epinotal declivity. Gaster large, longer than broad. Legs short and robust.

Habitat.—N.S. Wales: Mt. Victoria (F. E. Wilson, Oct. 1930).

Taken in the nest with workers. The specimen has no traces of either scutellum or wing sclerites.

Subfamily **Formicinae** Lepeletier 1836.

Genus MYRMECORHYNCHUS Andre 1896.

Myrmecorhynchus emeryi Andre.

(Pl. III, fig. 7–8–9.)

Andre, Rev. d'Ent. xv, p. 254, 1896, ♀.

Emery, Rend. Accad. Sc. Bologna, N.S. 2, p. 237, figs. 9–10, 1898, ♀.

Wheeler, Trans. Roy. Soc. S. Aust. xli, p. 16, pl. 1, figs. 1–4, 1917, ♀, 4.

Female.—Length, 6–6.5 mm. (not previously described).

Head yellowish red; mandibles darker; thorax, node, gaster and femora brownish; scapes, coxae, trochanters, and tibia yellow; funiculus and tarsi darker.

Mandibles very finely and densely striate, with large scattered punctures. Clypeus coarsely and irregularly striate. Head finely and densely reticulate. Pronotum and mesonotum more superficially reticulate. Scutellum smooth and shining. Epinotum finely transversely striate-reticulate. Node finely reticulate.

Hair yellow, long and erect, abundant throughout, shorter and oblique on antennae and legs. Pubescence not apparent except on funiculus.

Head as broad as long, broadest behind, sides convex, occipital border straight or feebly convex, angles broadly rounded. Mandibles triangular, dorsum strongly convex, furnished with seven strong teeth behind apex. Clypeus broadly produced in front, anterior border concave in middle, angles rounded. Frontal area large, transverse. Frontal carinae diverging behind, one-fourth broader in front than long. Scapes not extending to occipital border by fully their thickness; first segment of funiculus as long as the two following together, second to tenth as broad as long, apical as long as two preceding together. Eyes large and convex, placed at middle of sides. Ocelli prominent. Thorax fully one and one-half times longer than broad. Pronotum hardly visible from above. Mesonotum one-third broader than long, strongly convex in front, concave behind, parapsidal furrows sharply impressed. Mesonotum one-fourth broader than long, convex in front and behind. Metanotum shows as a narrow band. Epinotum two and one-half times broader than long. In profile pronotum short and vertical. Mesonotum strongly convex from apex to base. Scutellum very slightly higher than mesonotum. Metanotum raised and projecting behind. Epinotum convex, rounded into, and shorter than, declivity. Node three times broader than long, oval, convex above; in profile twice as high as long, almost parallel, dorsum convex. Gaster longer than broad. Legs robust. Wings hyaline, discoidal cell small.

Male.—Length, 6.5–7 mm.

Head and gaster reddish yellow; mandibles, antennae, thorax and legs yellow.

Mandibles smooth and shining, with scattered shallow punctures. Head finely and densely reticulate, somewhat coarser in front. Pronotum, mesonotum and scutellum superficially reticulate, epinotum irregularly reticulate. Node and gaster smooth and shining.

Hair yellow, short and erect, sparse throughout, oblique on antennae and gaster. Pubescence confined to antennae and legs, very fine and adpressed.

Head slightly broader than long, sides strongly convex, occipital border straight or very feebly convex. Mandibles almost half as long as head, edentate, terminal border concave, twice as long as basal border, the angle strongly produced, sharp. Clypeus feebly convex above, produced in front, broadly convex, strongly indented at middle. Frontal area triangular. Frontal carinae not margined. Base of scapes exposed. Scapes thickened at apex, extending beyond occipital border by one-fourth their length; first segment of funiculus one-fourth longer than second, the others longer than broad, fifth to twelfth thickened to apex, apical pointed, twice as long as broad. Eyes large, very convex, slightly in front of middle of sides. Ocelli large and prominent, transparent. Thorax one and three-fourths longer than broad. Pronotum, seen from above, short and crescent-like. Mesonotum one-third broader than long, convex in front, concave behind, parapsidal furrows very strongly impressed. Scutellum broader than long, oval. Epinotum twice as broad as long. In profile pronotum vertical, convex near top. Mesonotum high, strongly convex from apex to base. Scutellum broader than long, oval. Epinotum twice as broad as long. In profile pronotum vertical, convex near top. Mesonotum high, strongly convex from apex to base. Scutellum convex, slightly higher than mesonotum, metanotum not projecting behind. Epinotum flat on top, declivity oblique, feebly convex, longer than dorsum, into which it is rounded. Node twice as broad as long, oval, convex on top; in profile one and three-fourths higher than long, anterior and posterior faces feebly convex, dorsum strongly convex. Gaster one-fourth longer than broad.

Genital exserted. Valves slender. Legs long and robust. Wings with a small discoidal cell.

Habitat.—Queensland: National Park, Macpherson Range (A. Musgrave, 19–12–26).

Types in the Australian Museum, Sydney.

Myrmecorhynchus musgravei, sp. nov.

(Pl. III, fig. 10.)

Male.—Length, 4.5–5 mm.

Testaceous; gaster slightly darker on some examples; mandibles, antennae and legs yellow.

Mandibles and clypeus smooth and shining, with scattered shallow punctures. Head shining, irregularly and finely reticulate, front of mesonotum more coarsely so, with numerous large punctures. Epinotum finely irregularly reticulate. Scutellum, node and gaster smooth and shining.

Head one-sixth longer than broad, strongly convex behind eyes. Mandibles half the length of head, edentate, terminal border concave. Clypeus feebly convex above, anterior border produced, broadly convex, feebly concave in the middle. Frontal carinae not margined. Base of scapes exposed. Scapes thickened at apex, extending beyond occipital border by fully one-fourth their length; first segment of funiculus one-third longer than second, others longer than broad to twelfth, apical fully twice as long as broad. Eyes very large and convex, placed just in front of the sides. Ocelli large and prominent, a fine groove extending from anterior ocellus to front of frontal carinae. Thorax one and two-thirds longer than broad. Pronotum just visible from above, strongly convex. Mesonotum one-fifth longer than broad, strongly convex in front, straight behind, parapsidal furrows sharply impressed. Scutellum one-third broader than long, convex. Epinotum twice as broad as long, broadest in front. In profile pronotum erect, feebly convex. Mesonotum strongly convex in front, flattened behind. Scutellum convex, highest in front. Metanotum raised, inclined backward. Epinotum convex from base to bottom of declivity. Node twice as broad as long, oval, convex on top; in profile one-third higher than long, anterior face convex, rounded into dorsum, posterior face short and vertical. Gaster one-fourth larger than broad. Genitalia exserted, long and slender. Wings hyaline, discoidal cell large.

Habitat.—Queensland: National Park (A. Musgrave, 19–12–26).

Type in Australian Museum, Sydney.

Myrmecorhynchus carteri, sp. nov.

(Pl. III, fig. 11–12.)

Worker major.—Length, 4.3–4.7 mm.

Black; mandibles and antennae ochraceous; apical half of mandibles, anterior edge of pronotum, knees, tibia and tarsi ferruginous; node and gaster chocolate brown.

Shining. Mandibles very finely striate longitudinally. Head and thorax finely reticulate, having a circular direction, on pronotum and mesonotum. Node and gaster smooth.

Hair yellow, long, erect, very sparse throughout. Pubescence very fine and adpressed, abundant on antennae, sparse on legs, hardly apparent on body.

Head a fraction longer than broad, much broader behind than in front, sides and occipital border convex, angles broadly rounded. Mandibles triangular, furnished with eight strong, sharp teeth. Clypeus produced, the anterior border straight in middle. Frontal area transversely triangular. Frontal carinae one-fourth broader than long. Scapes extending beyond occipital border by one-fifth their length; first segment of funiculus as long as the three following together, second to ninth as broad as long, tenth slightly longer than broad, apical as long as the two preceding together. Eyes large, convex, placed about three-quarters of their length from anterior angle. Ocelli large. Thorax one and three-quarters times longer than broad. Pronotum one and two-thirds times broader than long, strongly convex, suture strongly impressed. Mesonotum almost circular, slightly broader than long. Constriction between meso- and epinotum wide and deep, the spiracles placed on top at sides of the depression. Epinotum slightly broader than long, strongly convex, posterior border almost straight. In profile pronotum and mesonotum convex, suture hardly indicated. Spiracles prominent in meso-epinotal depression. Epinotum strongly convex, rounded into declivity, the latter longer than dorsum. Node oval, fully twice as broad as long, convex laterally; in profile almost twice as high as long, anterior and posterior faces feebly convex, almost parallel, rounded into dorsum; a short blunt tooth in front below. Gaster one and two-third times longer than broad. Legs slender.

Worker minor.—Length, 3–3.3 mm.

Colour, sculpture and pilosity as in major from which it differs as follows:

Head one-seventh longer than broad, sides and occipital border strongly convex. Mandibles slightly longer and narrower. Scapes extending beyond occipital border by one-fourth their length. Dorsum of thorax similar, but in profile the epinotum higher and more convex. The node a little more slender, more pointed above.

Habitat.—N.S. Wales: Barrington Tops (H. J. Carter). Victoria: Kinglake (T. Greaves).

Myrmecorhynchus nitidus, sp. nov.

(Pl. III, fig. 13–16.)

Worker major.—Length, 5.5 mm.

Black. Mandibles and clypeus yellow, the latter with a blackish patch on the middle behind; antennae, trochanters, tibiae and tarsi reddish-yellow. Many examples have the apex of mandibles darker.

Smooth and shining, microscopically reticulate throughout.

Hair yellow, very sparse, short and erect. Pubescence absent except on funiculus where it is short and depressed.

Head very slightly longer than broad, broader behind than in front, sides convex, posterior border feebly convex, almost straight. Mandibles almost

half as long as head, terminal border furnished with seven large sharp teeth with a small one between them. Clypeus projecting and broadly convex in front. Frontal area small, triangular. Frontal carinae broad and flat, short, one and a half times broader than long, a feeble groove between them, extending to the anterior ocellus. Scapes extending beyond occipital border by almost twice their thickness; first segment of funiculus twice as long as broad, barely as long as the two following together, second to ninth slightly longer than broad, tenth as long as broad, apical twice as long as broad, as long as the two preceding together. Eyes very large and convex, in front of middle of sides. Ocelli small but prominent. Thorax fully twice as long as broad, strongly constricted at the mesonotum. Pronotum one-fifth broader than long, strongly convex in all directions. Mesonotum one and a half times broader than long. A deep and wide constriction between mesonotum and epinotum, the spiracles prominent at the sides on top. Epinotum one-fourth broader than long, strongly convex in all directions. In profile the pronotum and mesonotum forming a single convexity, the suture feebly indicated. Mesonotum much lower, flat on top, rounded into declivity, the latter oblique, almost as long as dorsum. Node twice as broad as long, oval; in profile as long as high, cone-shaped; a faint indication of a tooth on the ventral surface in front. Gaster one and a half times longer than broad. Legs long and slender.

Worker minor.—Length, 4.5 mm.

Colour, sculpture and pilosity as in the major.

Head one-fourth longer than broad, sides and occipital border strongly convex, broader behind than in front. Mandibles fully one-third as long as head, furnished with seven large teeth as in the major worker. Clypeus feebly carinate on the basal two-thirds. Frontal carinae slightly more raised at sides. Antennae similar. Eyes and ocelli smaller, the ocelli very small, hardly perceptible. Thorax somewhat similar but epinotum shorter and more convex. Node more slender and sharper above.

Female.—Length, 7.5 mm.

Colour, sculpture and pilosity as in worker major from which it differs as follows: Head almost parallel; occipital border feebly convex, angles rounded. Teeth on mandibles longer and stronger. Clypeus subcarinate on basal half. Eyes and ocelli larger. Pronotum short and convex. Mesonotum large, flat; parapsidal furrows deeply impressed. Scutellum highly polished. Epinotum very short and broad, declivity flat. Node similar. Gaster larger. Legs slender. Wings hyaline. Discoidal cell small.

Male.—Length, 6 mm.

Colour, sculpture and pilosity as in the worker.

Head one-sixth longer than broad, much broader behind than in front, sides and occipital border strongly convex. Mandibles fully half as long as head, somewhat sickle-shaped, inner and terminal borders concave, edentate. Clypeus produced, broadly convex in front. Frontal area large. Scapes slender, extending beyond occipital border by one-fifth their length; first segment of funiculus fully twice as long as broad, second to eleventh about one and three-quarter times longer than broad, apical two and a third times longer than broad. Eyes large, convex, placed in front of the middle of sides. Ocelli large and convex. Thorax twice as long as broad. Pronotum fully twice as broad as long, parapsidal furrows, and a short median furrow in front, deeply impressed, truncate and convex in front, tegulae yellow, projecting at sides. Scutellum one and one-half times broader than long, strongly convex

above. Metanotum appearing as a narrow deep impression. Epinotum one and two-thirds broader than long. In profile pronotum short and truncate in front, convex, separated from mesonotum by a strong excision. Mesonotum truncate and convex in front, dorsum flat, slightly raised at sides behind. Scutellum convex, lower behind. Epinotum rounded into declivity. Node almost twice as broad as long, oval, with a feeble longitudinal groove above; in profile one and one-half times higher than long, dome-shaped. Gaster one and one-half times longer than broad. Genitalia exserted, slender (fig. 15b). Legs long and slender. Wings hyaline; discoidal cell small.

Habitat.—Victoria: Cheltenham (L. B. Thorn), ☿ ♀ ♂, in dead branch of tree. Federal Capital Territory: Canberra (T. Greaves), ☿ ♂, in limb of tree.

Mr. Greaves informs me that the examples collected by him were in a branch seventy feet from the ground. Two species collected by the late Mr. Thorn were also obtained in trees, but apparently at no great height as Mr. Thorn secured examples whilst searching for Lycaenid larvae.

Myrmecorhynchus rufithorax, sp. nov.

(Pl. III, fig. 17–18.)

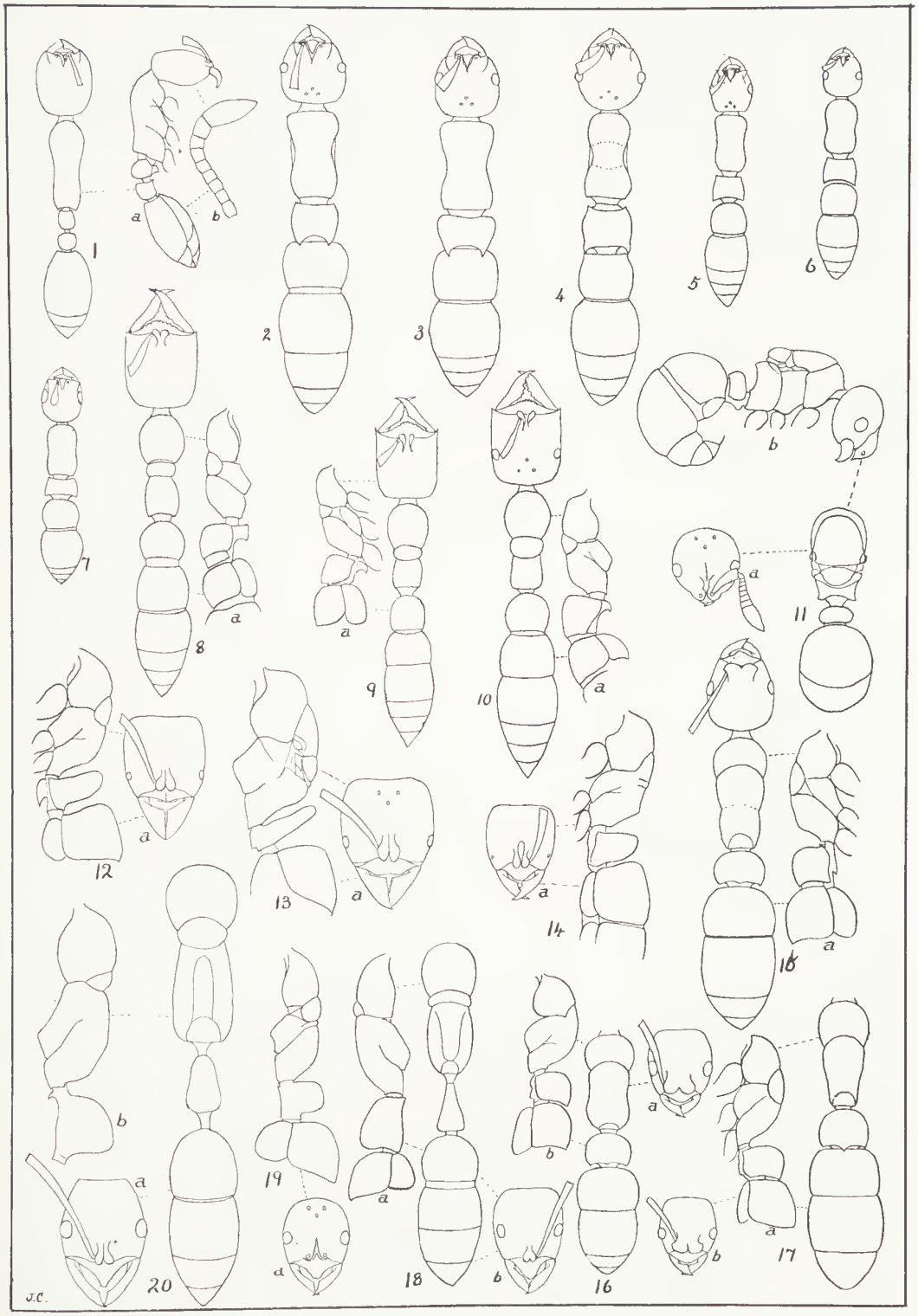
Worker major.—Length, 4.5 mm.

Head and gaster chocolate brown; mandibles yellow, apex darker, antennae, thorax, node and legs ferruginous.

Shining. Mandibles with a few scattered punctures. Clypeus finely striate longitudinally. Head very finely reticulate in front, superficially so behind. Dorsum of thorax superficially reticulate, with some shallow scattered punctures; sides of pronotum more strongly punctured, sides of mesonotum more coarsely and almost longitudinally striate-reticulate, sides of epinotum longitudinally striate. Node and gaster smooth.

Hair yellow, long and slender, abundant throughout, shorter and more bristle-like on antennae and legs. Pubescence yellow, sparse except on funiculus and coxae.

Head as long as broad, broadest just behind eyes, sides strongly convex; occipital border straight, angles rounded. Mandibles almost half the length of head, furnished with nine strong sharp teeth. Clypeus rather weakly convex, anterior border produced, broadly convex, almost straight at middle. Frontal area large, transversely triangular. Frontal carinae one-third broader than long, sharply margined on sides. Scapes extending beyond occipital border by one-fifth their length; first segment of funiculus longer than the two following together, second to eighth longer than broad, ninth and tenth as broad as long, apical pointed, twice as long as broad. Eyes circular, convex, placed at middle of sides. Ocelli small. Thorax one and three-fourths longer than broad. Pronotum one-fourth broader than long, strongly convex in all directions. Mesonotum half as broad as pronotum, as long as broad, circular. Meso-epinotal excision wide and deep, spiracles large, placed on top, at each side of dorsum. Epinotum broader than long, sides convex. In profile pronotum strongly convex, high in front. Mesonotum continuous with pro-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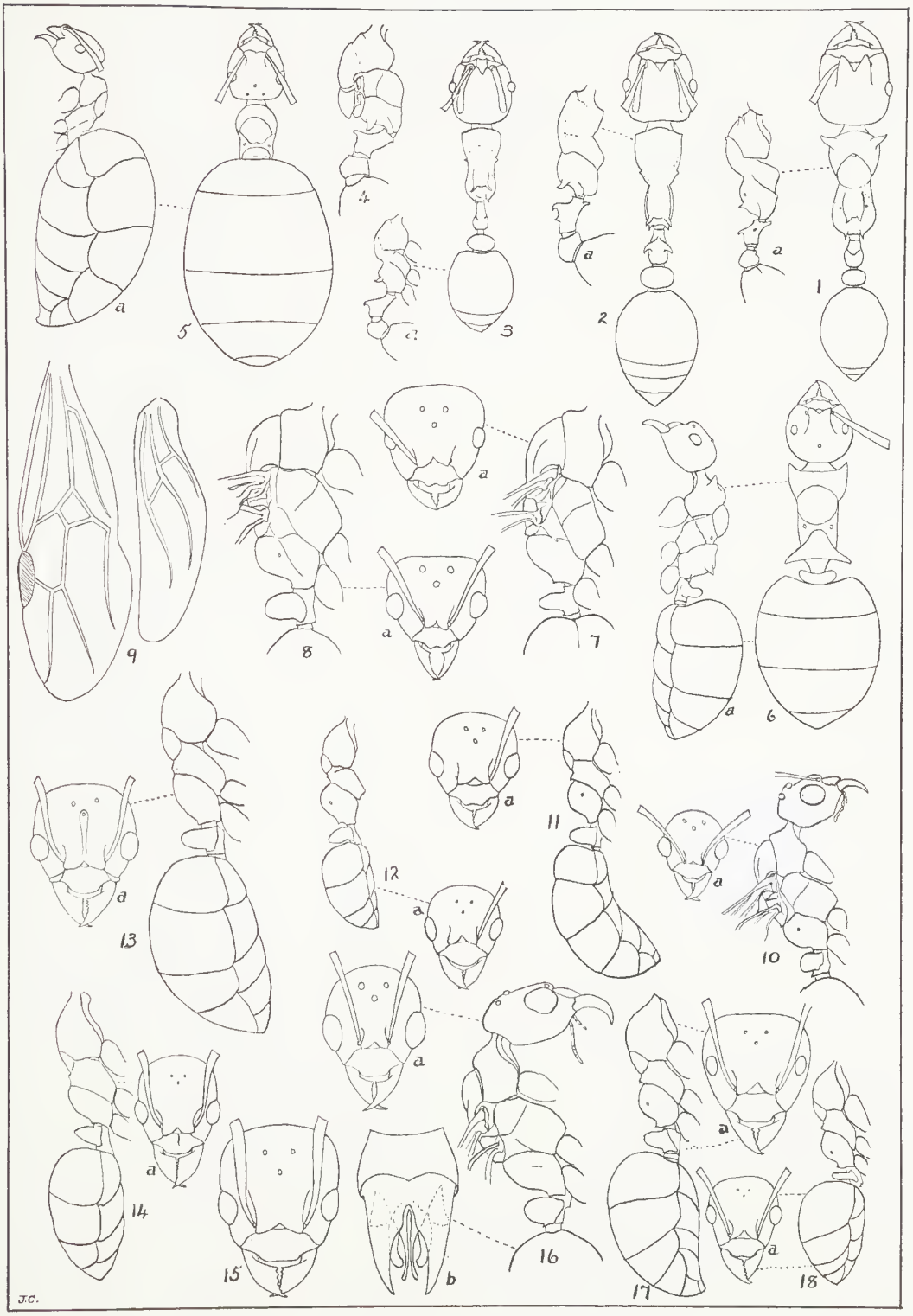
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notum, suture hardly visible. Spiracles high and tubercle-like. Epinotum strongly convex, rounded into declivity, latter short, concave at bottom. Node twice as broad as long, dorsum convex; in profile twice as high as long, almost parallel, dorsum strongly convex. Gaster longer than broad. Legs robust.

Worker minor.—Length, 3.5 mm.

Colour, sculpture and pilosity as in worker major.

Head slightly longer than broad, broadest just behind eyes, sides and occipital border convex. Ocelli feebly indicated. Scapes extend beyond occipital border by one-fourth their length. Thorax as in major, but more slender. Node thinner. In all other respects as in the worker major.

Habitat.—Victoria: Warburton (L. B. Thorn).

Near *M. emeryi* Andre.

Plate II.

Fig.
1. *Aenictus exiguus*, sp. nov.; worker.
2. *Phyracaces grandis*, sp. nov.; worker.
3. *P. pictus*, sp. nov.; worker.
4. *P. princeps*, sp. nov.; worker.
5. *P. greavesi*, sp. nov.; worker.
6. *P. aberrans*, sp. nov.; worker.
7. *P. pygmaeus*, sp. nov.; worker.
8. *Amblyopone* (*Fulakora*) *lucida*, sp. nov.; worker.
9, 10. *A.* (*F.*) *punctulata*, sp. nov.; worker (9); female (10).
11. *Discothyrea leae*, sp. nov.; female.
12, 13. *Euponera* (*Brachyponera*) *rufonigra*, sp. nov.; worker (12); female (13).
14. *Ectomomyrmex ruficornis*, sp. nov.; worker.
15. *Eubothroponera tasmaniensis* Forel; worker.
16. *E. reticulata*, sp. nov.; worker.
17. *E. septentrionalis*, sp. nov.; worker.
18, 19. *Leptogenys* (*Lobopelta*) *angustinoda*, sp. nov.; worker (18); female (19).
20. *L.* (*L.*) *hackeri*, sp. nov.; worker.

Plate III.

Fig.
1. *Podomyrma tricolor*, sp. nov.; worker.
2. *Dacryon ferruginea*, sp. nov.; worker.
3. *Lordomyrma rugosa*, sp. nov.; worker.
4. *L. rugosa*, sp. nov.; female.
5. *Bothriomyrmex wilsoni*, sp. nov.; worker.
6. *Dolichoderus* (*Hypoclinea*) *doriae* Emery; female.
7. *Myrmecorhynchus emeryi* Andre; female.
8, 9. *M. emeryi* Andre; male (8); wings of female (9).
10. *M. musgravei*, sp. nov.; male.
11, 12. *M. carteri*, sp. nov.; worker major (11); worker minor (12).
13, 14. *M. nitidus*, sp. nov.; worker major (13); worker minor (14).
15, 16. *M. nitidus*, sp. nov.; female (15); male, head and genitalia (16).
17, 18. *M. rufithorax*, sp. nov.; worker major (17); worker minor (18).

ANTS FROM THE OTWAY RANGES.

By John Clark, Entomologist, National Museum.

(Plate IV)

During January 1932 a short collecting trip was undertaken to the little frequented area near Beech Forest. Arrangements were greatly facilitated by Mr. MacRae, Forest Officer in charge of the district, to whose interest and enthusiasm much of our success was due. The camp was located in the heart of almost virgin forest on Turton's Track, near Mt. Sabine (1812 ft.), where in all directions deep and almost inaccessible gullies abound, the great wealth of ferns and undergrowth rendering progress difficult and slow.

The Otway Ranges consist of a deeply dissected plateau of Jurassic sandstones and mudstones between 1500 ft. and 1800 ft. above sea level. The average annual rainfall at Beech Forest exceeds 60 inches, but we were fortunate in having fine weather during our visit. The very wet climate is reflected in the fauna, Crustaceans being abundant, but most forms of Insect life scarce. Only two specimens of Peripatus were found. Carab beetles predominated over other forms and were more numerous in the damp gullies than on hill-tops. Ants were represented by fourteen species; they were practically confined to the higher ground and most of them were taken in rotten logs; no doubt other species exist, since only a very limited area was worked and no search was made for arboreal forms. On the return journey three days were spent at Gellibrand at the foot of the range where thirty species of ants were collected. Although less than twenty miles apart the two areas yielded totally different faunas, only four species of ants being common to both.

Of those species taken near Mount Sabine ten are new, the remainder being found on the Dandenong Ranges. The Ponerinae predominate with five species, four of which are new. Myrmicinae were represented by two species, both of which are new; Dolichoderinae by three, two being new; Formicinae by four species, three being new.

The five genera of Ponerinae belong to an ancient and widely distributed fauna. All are found in the mountainous areas of New Guinea, and, with the exception of *Trapeziopelta*, are also common to New Zealand. *Discothyrea* is found also in America. Of the Myrmicinae, only two species of *Monomorium* were found, but they were numerous in individuals, always occurring in

small nests. The genus *Solenopsis* has not previously been recorded from Victoria. The subfamily Dolichoderinae is represented by three species of *Iridomyrmex*, and it is interesting to note that none occurred in the bush, all the nests being found at the side of the road or near clearings. Of the Formicinae the most abundant, both in species and individuals, was the genus *Prolasius*, a genus until recently supposed to be confined to New Zealand. This genus had not been recognised in Australia until the recent visit of Dr. W. M. Wheeler who secured a number of species over a large area. The genus *Diodontolepis* is, so far as known, confined to Victoria. A notable feature at Mount Sabine was the absence of any species of the large and widely distributed genera *Myrmecia*, *Chalcoponera*, and *Rhytidoponera*, though the two former genera occur abundantly at the foot of the range.

The material from the foot of the range near Gellibrand was more varied. The country consists of cleared land, more or less open forest and sandy-heath-scrub. In the forest area was found a small nest of ants for which a new genus, *Pseudonotoncus*, has been erected. The habits as well as general structure suggest an affinity with *Notoncus*.

Family **FORMICIDAE** Latreille 1810.

Subfamily **Cerapachyinae** Forel 1893.

Genus EUSPHINCTUS Emery 1893.

Eusphinctus fulvipes, sp. nov.

(Pl. IV, fig. 1.)

Worker.—Length, 3.3–3.8 mm.

Chestnut-brown; mandibles, antennae and gaster castaneous; legs ochraceous.

Mandibles, head, thorax and node densely and rather coarsely covered with large shallow piligerous punctures; gaster similarly, but more finely, punctate; declivity shining.

Hair yellow, short and suberect, abundant throughout, longer than elsewhere on terminal segments of gaster. Pubescence yellow, very fine and adpressed.

Head one-sixth longer than broad, as broad in front as behind, sides feebly convex, occipital border straight, angles broadly rounded. Mandibles short, triangular, abruptly bent near their base, inner border short, terminal border edentate, in some examples very feebly denticulate. Clypeus short and

rounded. Frontal carinae erect, confluent, truncate behind. Carinae of cheeks sharply marked, almost meeting frontal carinae behind. Scapes greatly thickened to apex, extending to posterior third of head; first segment of funiculus slightly longer than broad, second to ninth broader than long, apical two and a half times longer than broad and as long as the four preceding together. No trace of eyes. Thorax twice as long as broad, constricted at the mesonotal area, feeble traces of sutures. The lateral and anterior borders rounded, posterior border straight, margined, the angles tooth-like. In profile feebly convex longitudinally, with a slight depression indicating the meso-epinotal suture; epinotal declivity short and concave, flat laterally, sub-margined on sides. Node very slightly broader than long, slightly broader behind than in front, anterior and posterior borders straight, sides convex; in profile longer than high, dome-shaped; a long, broad, sharp-pointed projection in front below. Postpetiole almost one-fourth broader than long, broader behind than in front, sides and anterior border straight; a deep and wide constriction between it and first segment of gaster. All segments of gaster separated by deep constructions. Pygidium broad and flat, bordered in front with short sharp bristles, becoming obsolete behind. Legs long and slender.

Female. Length, 3.8–4.2 mm.

Colour, sculpture and pilosity as in the worker. Head as broad as long, sides strongly convex. Eyes large, convex, situated slightly in front of middle of sides. Ocelli large. Mandibles more strongly denticulate. Thoracic sutures more strongly marked. Gaster much larger than that of the worker, the segments more widely separated. Pygidium larger and the bristles at sides longer and stronger.

Habitat.—Gellibrand, under stone, and one female under log.

Near *E. hirsutus* Clark, but more robust and more strongly sculptured.

Subfamily **Ponerinae** Lepeletier 1836.

Genus MYRMECIA Fabricius 1804.

Myrmecia crassinoda, sp. nov.

(Pl. IV, fig. 2.)

Worker.—Length, 16–20 mm.

Dark red, almost brown; gaster black; middle of forehead between frontal carinae and ocelli black, size of area varying in individuals; mandibles and clypeus castaneous; antennae, anterior legs and all tarsi ferruginous; middle and posterior femora and tibia brown.

Mandibles, postpetiole and gaster shining. Head strongly striate diverging outward behind. Pronotum longitudinally arched striate, transversely on a few examples. Mesonotum and epinotum transversely striate. Node circularly rugose.

Hair yellowish, long and erect, abundant throughout, short and suberect on legs. Pubescence yellow, very fine and adpressed, longer and coarser on clypeus and apical segments of gaster than elsewhere.

Head as long as broad, sides parallel, occipital border straight, angles rounded. Mandibles barely as long as head, external border feebly concave; inner border furnished with fourteen teeth, the third, seventh, ninth and eleventh large, reduced from eleventh to base. Clypeus widely and deeply excised in front, angles sharp. Frontal carinae erect. Eyes and ocelli large and prominent. Scapes extending beyond occipital border by one-fifth their length; second segment of funiculus very slightly longer than first, third shorter than first. Thorax two and three-fourths times longer than broad. Pronotum broader than long, slightly flattened above. Mesonotum circular, convex above. Epinotum longer than broad, convex laterally, with indications of a longitudinal median groove; in profile the dorsum almost flat, declivity short and convex. Node as long as broad, broader behind than in front; in profile higher than long, fully twice as long as the stalk in front, anterior and posterior faces vertical, dorsum almost flat, the angles rounded. Post-petiole broader than long, convex. First segment of gaster much broader than long. Legs short and robust.

Female.—Length, 21 mm. (Ergatoid).

Slightly larger and darker than the worker; sculpture coarser. Pilosity longer and more abundant. Pronotum similar. Mesonotum somewhat similar but with a depression at each side in front. Scutellum small but distinct. Wing pads present but no traces of wings. Node broader than long. In other respects similar.

Habitat.—Gellibrand.

Near *M. pulchra* Clark, but readily separated by the colour, sculpture and pilosity, in addition to the structural details.

Myrmecia crudelis Smith.

Cat. Hymn. Brit. Mus., vi, p. 147, 1858.

Originally described from Adelaide, S. Australia, this species is found in several places in Victoria. A few workers were found on tree trunks at Gellibrand.

Myrmecia simillima Smith.

Cat. Hymn. Brit. Mus., vi, p. 144, 1858.

Numerous nests of this species were found at Gellibrand. Many examples in nests have a bright violet sheen and are, in general, lighter in colour than the ordinary workers. It seems certain that it is to such examples Forel applied the varietal name *violacea*.

Myrmecia (Promyrmecia) pilosula Smith.

Cat. Hymn. Brit. Mus., vi, p. 146, 1858.

Many nests of this common and widely distributed species were found at Gellibrand. This is generally known as the "Black-jumper" and greatly respected on account of its sting. The nests are always in the ground and very populous.

Myrmecia (*Promyrmecia*) *fulvipes* Roger.

Ent. Zeitschr., v, p. 36, 1861.

This species is widely distributed in South Eastern Australia. It varies much in size and slightly in colour of the legs. One nest was found at Gellibrand.

Genus AMBLYOPONE Erichson 1842.

Amblyopone australis Erichson.

Arch. f. Naturg. 8, p. 260, 1842 : Wheeler, Proc. Amer. Acad. Arts & Sc. 62 (i), pp. 4–8, 1927.

Widely distributed throughout the mountainous parts of Australia and Tasmania. Extending from S.W. Aust., round the south and east coast, to N. Queensland. It is very variable in size and colour. Many nests were found at Beech Forest and at Gellibrand, all in rotten logs.

Subgenus Fulakora Mann 1919.

Amblyopone (*Fulakora*) *gracilis*, sp. nov.

(Pl. IV, figs. 3–4.)

Worker.—Length, 3.5–4.5 mm.

Castaneous ; legs more yellowish ; anterior angles of head brown.

Finely and densely reticulate-punctate on head, finely punctate elsewhere ; epinotal declivity very finely striate transversely. Mandibles longitudinally striate.

Hair yellow, short and erect, sparse throughout, except on apical segments of gaster. Pubescence yellow, short and adpressed, abundant throughout.

Head one-sixth longer than broad, broader in front than behind, sides straight, occipital border slightly concave, angles strongly rounded, anterior angles of sides produced as strong tooth-like projections. Mandibles long, narrow, sharply pointed, external border straight, inner border convex, furnished with seven large teeth, first two simple, the others bifid laterally. Clypeus strongly convex in front ; furnished with eight strong sharp teeth, the central pair joined at base. Frontal carinae short and erect, truncate and diverging behind, slightly overhanging the antennal insertions in front. Scapes

reaching the posterior third of head, almost uniformly thickened to apex; first segment of funiculus almost as long as the three following together, the others subequal to apical which is as long as the four preceding together. Eyes minute, composed of about seven facets, placed at posterior third of head. Anterior ocellus very minute, situated in a deep fovea, posterior ocelli represented by minute punctures. Thorax twice as long as broad. Pronotum as broad as long, strongly convex on sides and in front, feebly convex above. Mesonotum almost twice as broad as long. Epinotum longer than broad; epinotal declivity flat, the superior border rounded into dorsum. In profile the top of thorax straight, the pro-mesonotal suture deeply impressed. Node as long as broad, sides and anterior border strongly convex, in profile longer than high, the anterior face and dorsum forming a right angle, the corner rounded. A long broad translucent projection in front below, as high as long, with a small circular perforation slightly in front of the middle. Postpetiole broader than long, broader behind than in front, separated from the petiole and gaster by wide constrictions. Gaster slender. Legs long and slender.

Female.—Length, 5 mm. (Dealated).

Similar to worker but larger and more robust. The head is as broad behind as in front. Eyes and ocelli large.

Habitat.—Beech Forest. Two nests under rotten logs.

Much larger, and not close to any of the previously known forms. Many females were found in each nest, all were dealated. They are much more active than the members of *Amblyopone*, although like them they curl up and remain motionless for a few moments when disturbed.

Genus DISCOTHYREA Roger 1863.

Discothyrea turtoni, sp. nov.

(Pl. IV, figs. 5–6.)

Worker.—Length, 2.3 mm.

Russet; apical segment of antennae and legs lighter.

Pubescence very fine, short and abundant giving a somewhat silky sheen.

Head longer than broad, broadest just behind the eyes, sides and occipital border convex. Mandibles triangular, edentate. Front of head produced and overhanging mandibles, the frontal carinae and antennae situated on the projection. Frontal carinae short, erect, truncate in front and behind, appearing as a thin blade separating the antennae and by no means covering their insertions. Scapes extending slightly beyond the eyes, thickened towards apex; apical segment of funiculus as long as the other seven together, and one and three-quarters times longer than broad. Eyes small, circular, situated at the middle of the sides of head. Thorax one and one-half times longer than broad, pronotum twice as broad as epinotum and three times as broad as long, convex in front, anterior angles bluntly rounded. Pro-mesonotal suture

feebly indicated. Meso-epinotal suture not visible. In profile convex longitudinally, pro-mesonotal suture indicated, slightly depressed at epinotum, declivity straight or feebly concave, vertical, top edge feebly rounded into dorsum. Node twice as broad as long, anterior face and sides strongly convex, posterior face almost straight ; in profile almost twice as high as long, anterior face and dorsum convex, posterior face straight ; a broad blunt tooth in front below. Postpetiole as long as broad. Apical segments of gaster turned under. Legs short and robust.

Female.—Length, 2–6 mm.

Colour, sculpture and pilosity as in the worker. Eyes much larger, rather flat. Ocelli prominent. Thorax one and one-half times longer than broad. Pronotum scarcely visible from above. Mesonotum as broad as long, sides and anterior border strongly convex ; dorsum flattened, or feebly depressed behind. Scutellum oval, one-third broader than long, posterior border concave. Node twice as broad as long, slightly broader behind, sides and posterior border straight, anterior border feebly convex. Wings missing. In other respects similar to the worker.

Habitat.—Beech Forest.

Two very small nests found under logs, in both instances along with nest of *Amblyopone* (*Fulakora*) *gracilis*. This species comes nearest to *D. bidens* Clark from Warburton but is readily distinguished by the formation of epinotum and node, in addition to the colour.

Genus TRAPEZIOPELTA Mayr 1862.

Trapeziopelta diadela, sp. nov.

(Pl. IV, figs. 7–8.)

Worker.—Length, 4.5 mm.

Castaneous ; epinotum, node and first segment of gaster black ; legs testaceous. Some examples are more or less suffused with black throughout.

Shining. Head finely and superficially punctate. Mandibles with very sparse, shallow, scattered punctures. Top of thorax polished, with scattered shallow punctures towards the sides, coarser than on head. Sides of pronotum smooth and with few scattered punctures ; rest of sides, including node, very finely striate longitudinally and with scattered punctures. Epinotal declivity punctate. Postpetiole and gaster with fine piligerous punctures.

Head as broad as long, as broad in front as behind, sides and occipital border feebly convex, angles strongly rounded. Mandibles about one-fourth shorter than head, external border concave, inner border strongly convex, furnished with two large blunt teeth near the middle and a small, more or less obsolete, tooth near the apex ; the second large tooth is situated just behind the middle and forms an angle from where the mandible is rapidly reduced to base ; the first is situated about one-third between second and apex. Clypeus very short, truncate in front. Frontal carinae produced, overhanging clypeus and base of mandibles, truncate in front, approximate, confluent behind, separated by a deep narrow groove which extends to the posterior third of head ; the

lobes overhanging the antennal insertions. Antennae stout, scapes not extending to occipital border, gradually thickened to apex; first segment of funiculus as long as the three following together, seventh to tenth broader than long, apical twice as long as broad and as long as the three preceding together. Eyes small, circular and flat, consisting of about twelve facets, situated at the anterior fourth of head, or about twice its diameter from base of mandible. Ocelli absent. Thorax twice as long as broad, sutures deeply impressed. Pronotum about one-third broader than long, sides and anterior border convex. Mesonotum oval, one-third broader than long, convex in all directions. Epinotum as broad as long. In profile feebly convex longitudinally, the declivity short and abrupt, rounded into dorsum. Node twice as broad as long, front and sides strongly convex; in profile fully one-third higher than long, the anterior face descending at a steep angle, the posterior face almost vertical, dorsum slightly convex; a long blunt process in front below. Post-petiole one-third broader than long, truncate in front. First segment of gaster one-third broader than long. Legs stout.

Female.—Length, 5 mm. (Dealated).

Very similar to the worker but with much larger eyes and well developed ocelli. Scapes shorter, not extending beyond posterior ocelli. The parapsidal furrows deeply impressed.

Habitat.—Turton's Track, Beech Forest.

Two small nests were found in very rotten beech logs.

It is with some diffidence that the species has been placed in this genus, which has not previously been recorded from Australia. From the description this species is near *T. xiphas* Emery from New Guinea.

Genus PONERA Latreille 1802.

Ponera scitula, sp. nov.

(Pl. IV, figs. 9–11.)

Worker.—Length, 3 mm.

Head and gaster black; thorax brown; mandibles, clypeus, antennae and legs yellowish red.

Smooth and subopaque. Very finely and densely punctate throughout.

Hair yellow, rather long and suberect on thorax, node and gaster, not apparent on antennae and legs. Pubescence yellow, fine and adpressed throughout, stouter on antennae and legs than elsewhere.

Head one-fifth longer than broad, as broad in front as behind, sides feebly convex, occipital border straight. Mandibles triangular, almost half as long as head; terminal border furnished with nine strong sharp teeth. Clypeus produced and broadly rounded in front. Frontal carinae flattened above, separated by a fine shallow groove which extends to the posterior third of head. Scapes extending to the occipital border, gradually thickened to their apex; first segment of funiculus as long as three following, apical twice as

long as broad and longer than the two preceding together. Eyes small, situated at the anterior third of head. Thorax twice as long as broad. Pronotum one-third broader than long, strongly convex. Mesonotum one-fourth broader than long. Epinotum slightly broader than long; in profile feebly convex longitudinally, the sutures feebly impressed, the declivity abrupt, as long as dorsum of epinotum, the lateral and superior borders bluntly margined. Node three times as broad as long, convex in front, flattened behind, in profile twice as long at the base as above, the anterior face vertical; there is a long broad projection in front below, longer than top of node, the corners sharp. Postpetiole fully one-third broader than long, truncate in front, sides and anterior border convex. First segment of gaster one-fourth broader than long, as broad in front as behind. Legs slender.

Female.—Length, 3.5 mm.

Colour, sculpture and pilosity as in the worker. Larger and more robust. Head larger, broader behind than in front. Eyes and ocelli large. Teeth of mandibles somewhat finer. Parapsidal furrows well defined. Node thinner above, more scale-like. Wings missing.

Ergatoid female.—Length, 3 mm.

Exactly midway between the worker and female. The eyes are smaller and more flattened than in the female, ocelli also much smaller. Thorax as in worker, but scutellum and metanotum developed. There are no traces of wing pads.

Habitat.—Turton's Track, Otway Range.

Near *P. sulciceps* Clark but readily distinguished by the shape of the node.

Ponera decora, sp. nov.

(Pl. IV, fig. 12–13.)

Worker.—Length, 2.8–3.4 mm.

Ochraceous tawny; first segment of gaster infuscated, brownish.

Shining, very finely and densely punctate.

Hair yellow, long and erect, not abundant except on gaster. Pubescence yellow, fine and adpressed, abundant throughout.

Head one-fifth longer than broad, very slightly broader behind than in front, sides strongly convex, occipital border straight, angles rounded. Mandibles half as long as head, terminal border furnished with eight teeth. Clypeus feebly carinate, produced and convex in front. Frontal carinae lobe-like, separated by a narrow, feeble, short groove which hardly extends beyond carinae. Scapes extending beyond occipital border by fully their thickness; first segment of funiculus as long as three following, apical segment fully twice as long as broad and as long as the three preceding together. Eyes moderately large, flat, placed about five times their width from the anterior border of side of head. Thorax twice as long as broad. Pronotum one-third broader than long, strongly convex in front and on sides. Mesonotum slightly broader than long, almost circular, both sutures strongly impressed. Epinotum narrow on top, twice as long as broad, and twice as broad behind as in front. In profile

the mesonotum raised above the level of pronotum and epinotum, the latter distinctly concave in the middle, the sutures deeply impressed; epinotal declivity rounded into dorsum, the lateral borders submarginate. Node twice as broad as long, front and sides united in one convexity, posterior face flat; in profile twice as high as long, twice as long at the base as on top, anterior face vertical, posterior face straight, inclined forward, dorsum convex; a broad flat plate-like projection in front, longer than high. Postpetiole broader than long, anterior face straight and truncate, sides convex. A distinct constriction between postpetiole and first segment of gaster, the latter broader than long, strongly convex on sides. Legs short and stout.

Female.—Length, 3.8 mm.

Differs from the worker as follows: Head broader behind than in front. Eyes large, placed about their diameter from the anterior angle of head. Ocelli large. Mesonotum flattened above, parapsidal furrows deeply impressed. Epinotal declivity almost twice as long as dorsum. Node much more slender, almost sharp above. Wings missing.

Habitat.—Gellibrand; under logs.

Ponera rectidens, sp. nov.

(Pl. IV, fig. 14.)

Worker.—Length, 2.5 mm.

Black; mandibles, clypeus, antennae and legs dull reddish yellow.

Mandibles and clypeus shining, finely and sparsely punctate. Head very densely and finely punctate, rest of body shining, with very fine, shallow, scattered piligerous punctures.

Hair yellow, long and erect, abundant only on gaster, not apparent elsewhere. Pubescence yellow, rather long and adpressed, abundant throughout, shorter on antennae and legs.

Head one-fourth longer than broad, slightly broader behind than in front, sides convex, occipital border straight or feebly concave, angles rounded. Mandibles not half the length of head, terminal border long, furnished with three strong sharp teeth in front, three or four obsolete teeth behind. Clypeus short, broadly rounded and feebly produced in front, carinate on top behind, the carinae feeble and somewhat bifurcated in front. Frontal carinae approximate, short and narrow, separated by a very feeble suture which is not continued behind. Scapes just reach occipital border; first segment of funiculus as long as the three following, others subequal to apical which is twice as long as broad and longer than the three preceding together. Thorax barely twice as long as broad. Pronotum one-third broader than long, strongly convex in all directions. Mesonotum one-fifth broader than long, almost circular. Epinotum twice as long as broad on top, dorsum narrow, parallel and convex laterally. In profile the pronotum convex, lower than mesonotum, a sharp excision between the two. Mesonotum and epinotum together straight, suture hardly visible, declivity flat, at an acute angle, long as the dorsum, sides submarginate forming a distinct sharp angle at sides of superior border, middle of this border bluntly rounded, giving a somewhat concave appearance from above. Node fully three times broader than long, flat behind, sides and front hemispherical; in profile one-third longer at base than on top, anterior face

feebly convex, posterior face inclined forward, straight or feebly concave; a broad plate-like projection in front below, as long as base of node. Postpetiole fully one and a half times broader than long, sides and anterior border feebly convex, the latter truncate in front. A sharp constriction between postpetiole and first segment of gaster. Legs long and slender.

Habitat.—Gellibrand.

Near *P. scitula* in size and colour but distinguished by the shape of the head, thorax and node.

Genus CHALCOPONERA Emery 1897.

Chalcoponera metallica Smith, var. *tasmaniensis* Em.

Rend. Acad. Sc. Bologna, p. 232, 1897, ♀.

This variety was abundant at Gellibrand. Nests under stones.

Subfamily **Myrmicinae** Lepeletier 1836.

Genus APHAENOGASTER Mayr 1853.

Subgenus Nystalomyrma Wheeler 1916.

Aphaenogaster (*Nystalomyrma*) *longiceps* Smith.

Cat. Hymn. Brit. Mus. vi, p. 128, 1858; Wheeler, Trans. Roy. Soc. S. Aust., 40, p. 216, 1916.

The crater-like nests of this species were common at Gellibrand.

Genus PHEIDOLE Westwood 1841.

Pheidole gellibrandi, sp. nov.

(Pl. IV, figs. 15–16).

Worker major.—Length, 4–5 mm.

Head ferruginous; mandibles, thorax and gaster chestnut; antennae and legs ochraceous.

Mandibles smooth, with shallow, scattered punctures. Anterior two-thirds of head longitudinally striate, these diverging slightly behind; posterior third transversely striate-reticulate, the interstices shining, microscopically reticulate. Pronotum and mesonotum transversely striate-reticulate. Epinotum and nodes densely and finely punctate. Gaster smooth and shining.

Hair yellow, rather long and erect, abundant throughout, shorter and suberect on antennae and legs.

Head slightly longer than broad, sides straight to posterior third, from there reduced and convex behind. Occipital border deeply excised in the middle, forming two strongly rounded angles. Mandibles edentate, with a distinct notch near apex, large and triangular. Clypeus short, produced in front, with a semi-circular excision in the middle, the sides forming sharp teeth-like angles. Frontal carinae short and broad, overhanging the antennal insertions. Scapes short, not extending to middle of head; first segment of funiculus as long as the four following together, second to eighth broader than long, ninth and tenth longer than broad, apical two and a half times longer than broad and longer than the three preceding together. Eyes small, feebly convex, situated at anterior fourth of sides. Pronotum and mesonotum together as broad as long, almost circular. Epinotum one-third longer than broad, sides parallel, furnished behind with two long slender spines directed upward and backward. In profile the pronotum and mesonotum united in a large dome-shaped convexity; epinotum straight, declivity short, forming a right angle with dorsum, the spines sharply pointed. Node sharply pointed above, concave in the middle; in profile one-fourth longer than high, the anterior face descending at an oblique angle; feebly concave. Postpetiole twice as broad as long, oval; in profile dome-shaped. First segment of gaster almost one-third broader than long, sides and front strongly convex. Legs short and robust. Femora greatly thickened at the middle.

Worker minor.—Length, 2–2.5 mm.

Chestnut-brown; antennae and legs lighter.

Sculpture as in worker major, but slightly coarser and mandibles striate. Pilosity similar.

Head as long as broad, sides and occipital border convex. Mandibles furnished with six or seven sharp teeth behind the apex. Clypeus produced, anterior border straight or very feebly concave. Frontal carinae longer, more lobe-like in front. Scapes reaching the occipital border; funiculus as in worker major. Eyes convex, situated in front of the middle of sides. Thorax as in worker major. Node a little more slender, dorsum convex. The remainder as in the major.

Habitat.—Gellibrand.

A nest under a log. Near *P. ampla* Forel but readily separated by the shape of epinotum, spines and nodes, as well as by the strongly marked sculpturing.

Genus MONOMORIUM Mayr 1855.

Subgenus NOTOMYRMEX Emery 1915.

Monomorium (Notomyrmex) sculpturatum, sp. nov.

(Pl. IV, figs. 17–18.)

Worker.—Length, 2.7 mm.

Bright ferruginous; apex of first segment of gaster and middle segments of funiculus infuscated; apex of antennae, scapes and legs ochraceous.

Shining. Mandibles rather coarsely striate punctate. Head superficially striate, the striae diverging outward behind from the frontal carinae, leaving a triangular space on middle smooth, almost encircling the antennal fovea in front; clypeus strongly striate longitudinally, these striae almost forming carinae. Pronotum and mesonotum with transversely arched striae, coarser than on head, becoming longitudinal on sides; epinotum longitudinally striate on top. In profile the side of pronotum almost smooth, sides of mesonotum and epinotum coarsely striate-rugose. Nodes coarsely and irregularly rugose. Gaster smooth, with scattered shallow piligerous punctures.

Hair yellow, long and erect, abundant throughout, shorter on antennae and legs. Pubescence whitish, very fine and adpressed, apparent only on antennae.

Head slightly longer than broad, broader in front than behind, sides strongly, occipital border feebly, convex. Mandibles barely half as long as head, rather broad, terminal border short, apex long and sharp, furnished with two strong sharp teeth equally spaced between apex and angle, the angle is formed by a short sharp tooth. Clypeus produced, high and overhanging, the dorsum convex longitudinally, level with top of frontal carinae, the anterior border almost as wide as frontal carinae, feebly concave. Frontal area small and semicircular. Frontal carinae short and lobe-like, not overhanging antennal insertions, broader than long, separated by at least the width of lobe. Scapes slightly thicker near middle than at apex, not extending to occipital border by more than their greatest thickness; first segment of funiculus as long as the four following together, second to seventh broader than long, ninth and tenth as broad as long, apical pointed, as long as the six preceding together. Eyes convex, situated in front of middle of sides. No ocelli. Thorax twice as long as broad, strongly constricted at the meso-epinotal suture, pro-mesonotal suture feebly defined. Pronotum one and one-half times broader than long, sides and front strongly convex. Mesonotum longer than broad, almost twice as broad in front as behind, convex in all directions. Meso-epinotal suture deep. Epinotum twice as long as broad, terminated behind by two long slender spines directed slightly outward and upward, barely as long as the interval between them at base; the peculiar striation gives the dorsum a marginate appearance. In profile pronotum and mesonotum united in a convexity. Epinotum lower than mesonotum, convex, declivity abrupt, as long as dorsum, the spines directed upward. Node as long as broad, broader behind than in front, almost circular; in profile one-third higher than long, almost dome-shaped but slightly higher in front than behind, the stalk in front almost as long as node; a short broad tooth in front directed strongly forward. Postpetiole one-third broader than long, oval; in profile higher than long, dome-shaped with a short plate-like process below, extending the full length of base. First segment of gaster, oval, one-sixth longer than broad, occupying almost the whole gaster. Legs long and slender; all the femora bent and greatly thickened at the apical third. Tibia thickened towards apex.

Female.—Length, 3.5 mm.

Similar to the worker but the gaster darker and the ocelli encircled by a brownish patch. Sculpture somewhat closer and coarser, top of clypeus and mesonotum smooth and shining. Pilosity longer and more abundant. Eyes larger, ocelli well developed. Parapsidal furrows short but well impressed. Spines of epinotum slightly stouter.

Habitat.—Beech Forest, in rotten logs.

In size, colour and sculpture this species closely resembles *Huberia bruni* Forel from New Zealand.

Monomorium (Notomyrmex) hemiphaeum, sp. nov.

(Pl. IV, fig. 19–20.)

Worker.—Length, 2.8–3.5 mm.

Bright ferruginous; eyes, apex of first and whole of second and third segments of gaster black.

Smooth and shining throughout, mandibles strongly punctate. Hair yellow, long and erect, abundant throughout, shorter on antennae and legs.

Head one-fifth longer than broad, sides convex, occipital border straight or feebly convex, angles strongly rounded. Mandibles half as long as head, furnished with four strong sharp teeth behind the apex. Clypeus projecting strongly in front, the anterior border straight. Frontal carinae very short and widely separated. Scapes not extending to occipital border by about their thickness; first segment of funiculus as long as the three following together, second to eighth broader than long, ninth and tenth as long as broad, apical fully twice as long as broad and as long as the six preceding together. Eyes small and convex. Thorax twice as broad as long. Pro-mesonotal suture feebly marked. Meso-epinotal suture deeply impressed. Pronotum one and one-half times broader than long. Mesonotum as long as broad, much narrower behind than in front. Epinotum as long as broad, with a feeble longitudinal impression in the middle, posterior border concave. In profile pronotum and mesonotum united in a strong convexity, without an impression at the suture. Meso-epinotal excision deep and broad. Epinotum convex, the declivity very short and rounded into dorsum. Node slightly broader than long, almost circular; in profile the anterior face at an oblique angle, slightly concave, dorsum and posterior face united in a convexity, almost two-thirds longer than the stalk in front; a feeble tooth in front below. Postpetiole slightly broader than node, circular, in profile almost circular, smaller than node. First segment of gaster very slightly longer than broad, twice as broad behind as in front. Sides strongly convex.

Female.—Length, 3.7 mm. (Ergatoid.)

Colour, sculpture and pilosity as in the worker. Eyes much larger, placed nearer to front of head. Ocelli large and convex. Thorax more robust. Pro-mesonotal suture scarcely visible. Pronotum and mesonotum equal in length. Scutellum half as long as mesonotum, sutures well impressed. Metanotum short but distinct. Epinotum concave behind, the posterior angles short; in profile convex longitudinally, metanotal sutures only showing on dorsum, the other sutures well impressed on sides; but without traces of wing pads. Epinotal declivity short, slightly convex, angles bluntly rounded. Node and postpetiole as in the worker, but the tooth on ventral surface more plate-like. Gaster much larger.

Habitat.—Beech Forest, 3 nests; Gellibrand, one small nest.

Near *M. (N) leae* Forel from Tasmania but smaller. The epinotum and nodes differently shaped.

Monomorium (Notomyrmex) rubriceps Mayr, var. *cincta* Wheeler.

Proc. Amer. Acad. Sc. Washington, 3, p. 114, fig. 3, 1917, ♀ ♀.

A large colony of this variety was found nesting in a rotten log at Gellibrand.

Genus SOLENOPSIS Westwood 1841.

Solenopsis fusciventris, sp. nov.

(Pl. IV, fig. 21.)

Worker.—Length, 1.3–1.8 mm.

Ochraceous; antennae and legs slightly paler; gaster darker with an indistinct fuscus tinge on apical third of first segment.

Smooth and shining, with scattered shallow piligerous punctures. Faint indications of striae between frontal carinae.

Hair white, moderately long and abundant throughout, suberect; shorter and more adpressed on antennae and legs. Pubescence not apparent.

Head one-sixth longer than broad, as broad in front as behind, sides feebly convex, occipital border straight, angles rounded. Mandibles triangular, with a long sharp point, and four large sharp teeth behind on terminal border. Clypeus strongly projecting in front, overhanging mandibles, the anterior border furnished with four strong, sharp teeth, the two in centre making the termination of two strong sharp carinae above, concave and shining between carinae. Frontal carinae very short, diverging outward behind. Scapes not reaching the occipital border by fully their thickness; first segment of funiculus as long as the four following together, two to seven short, broader than long, eighth as long as broad, apical two and a half times as long as broad, the eighth and ninth forming a distinct club longer than remainder of funiculus. Eyes small and flat, situated at anterior third of sides. Thorax barely twice as long as broad, pro-mesonotal suture not defined, meso-epinotal suture strongly impressed. Pro-mesonotum almost three times broader in front than behind. Epinotum very short, sides parallel; in profile pronotum strongly convex in front, feebly so behind, the epinotum convex, descending from the suture into the declivity with which it is united in a continuous convexity. Node twice as broad as long, transverse oval, in profile twice as high as long, dome-shaped, as long as the stalk in front; there is a short blunt tooth in front below. Postpetiole transverse oval, one and three-fourths times broader than long; in profile higher than long, strongly convex above. First segment of gaster fully twice as long as broad, broadest at middle, occupying almost two-thirds of gaster. Legs robust, femora thickened near apical third.

Habitat.—Gellibrand. A small nest in a Termite infested log.

Near *S. froggatti* Forel from Tasmania, but readily separated by the form of the nodes.

Subfamily **Dolichoderinae** Forel 1878.

Genus IRIDOMYRMEX Mayr 1862.

Iridomyrmex vicina, sp. nov.

(Pl. IV, fig. 22.)

Worker.—Length, 3 mm.

Dull bluish-green; mandibles, antennae and legs brownish; scapes and tarsi lighter.

Smooth, subnitid, microscopically punctate throughout.

Hair yellow, very short, erect, longer on ventral surface of gaster, rather sparse throughout. Pubescence whitish very fine and adpressed, abundant throughout but not hiding the sculpture.

Head slightly longer than broad, much broader behind than in front, sides convex, occipital border straight, angles strongly rounded. Mandibles furnished with nine to ten teeth, the first six or seven strong and sharp. Clypeus convex, anterior border straight and broad, with a somewhat truncate appearance. Frontal area elongate triangular. Frontal carinae flat, as long as broad. Scapes passing occipital border by almost one-fourth their length; first segment of funiculus three times longer than broad, second to ninth longer than broad, tenth as broad as long, apical as long as two preceding together. Eyes circular, flat, placed at middle of sides. Thorax twice as long as broad. Sutures well defined. Pronotum one-third broader than long, strongly convex in all directions. Mesonotum as long as broad, sides almost parallel, strongly convex laterally. Epinotum as long as broad, parallel with mesonotum. In profile pronotum strongly and evenly convex, suture sharply impressed. Mesonotum straight, very low behind. Epinotum dome-shaped, almost half its length higher than mesonotum, declivity continuous with dorsal convexity. Node scale-like, convex transversely; in profile inclined slightly forward, anterior face convex, posterior face flat. Gaster ovate. Legs long and slender.

Female.—Length, 7–8 mm.

Colour and sculpture as in the worker. Pubescence more abundant. Head as long as broad. Eyes and ocelli large. Scapes exceeding the occipital border by fully their thickness. Pronotum hardly visible from above. Mesonotum one-third broader than long, front and sides strongly convex, dorsum convex in all directions, parapsidal furrow sharply defined. Scutellum one-fifth broader than long, strongly convex behind. Epinotum almost twice as broad as long. Node fully twice as broad as long, convex in front. Gaster twice as long as broad. Legs slender.

Habitat.—Beech Forest; several small nests under stones.

Much more robust than *gracilis* Lowne which it resembles. The structure of the head and node readily separate them.

Iridomyrmex mattiroli Emery.

Rend. Accad. Sc. Bologna, p. 238, fig. 8, 1897, ♀.

Two nests of this species were obtained at Gellibrand.

Iridomyrmex itinerans Lowne.

The Entomol., London, 2, p. 278, ♀.

Many examples were found on tree-trunks at Gellibrand.

Iridomyrmex darwinianus Forel.

Ann. Mus. Hung. 5, p. 28, 1907, ♀.

Found at Beech Forest and Gellibrand but not common. The examples from Gellibrand appear to belong to the subspecies *leae* Forel but are certainly closer to the typical form.

Iridomyrmex foetans Clark.

Vic. Naturl. xlvi, p. 122, pl. 1, fig. 1, 1929, ☿.

Many examples were found on tree-trunks at Beech Forest and Gellibrand. This species emits a powerful and disagreeable odour.

Subfamily **Formicinae** Lepeletier 1836.

Genus DIODONTOLEPIS Wheeler 1920.

Diodontolepis spinisquamis (Andre).

Rev. d'Ent. Caen, p. 254, 1896, ☿ ♀ ♂. (*Melophorus*).

Diodontolepis spinisquamis Wheeler, Bull. Amer. Mus. Nat. Hist., xlv, p. 694, 1922.

Melophorus spinisquamis Emery, Gen. Insect. Fasc. 183, p. 12, 1925.

Two nests were found under logs near Gellibrand, and one at Beech Forest. Emery is in error in sinking Wheeler's generic name for this species. In addition to the anatomical details the habits, too, are different from those of *Melophorus*. Some examples have a distinct tubercle on posterior margin of epinotum, and distinct, but small, spines on node.

Genus NOTONCUS Emery 1895.

Notoncus foreli Andre.

Rev. d'Ent. Caen, p. 256, 1896, ☿.

One small nest under log at Gellibrand.

Genus PSEUDONOTONCUS, gen. nov.

Worker.—Monomorphic, varying slightly in size. Mandibles triangular, dentate. Maxillary palpi with six segments, labial palpi with four segments. Clypeus broad, carinate, produced in front, slightly overhanging mandibles. Frontal area small, transverse. Frontal carinae feeble, diverging behind. Antennae twelve segmented. Scapes extending beyond occipital border. Eyes circular, placed at posterior third of head. Ocelli distinct. Pronotum broad, strongly convex in all directions. Pro-mesonotal suture deep and wide. Spiracles placed on dorsum at anterior of depression. Posterior border of epinotum furnished with two long sharp spines; flattened laterally. Two similar but shorter spines near middle of epinotal declivity at sides. Node thick, furnished with two spines similar to those on epinotum, parallel, directed backward; a short blunt tooth below in front directed forward. Gaster oval. Legs robust, all femora and tibiae thickened at middle. Tibia with one pectinate and one bristle-like spur; middle and posterior tibiae each with one strong bristle-like spur. Claws simple.

Female.—Differs from the worker only in slightly larger size; the spines of epinotum slightly shorter. Wings missing.

Genotype, *Pseudonotoncus hirsutus*, n. sp.

In size and sculpture this genus is apparently nearest to *Notoncus*. The same variation in size of workers is found in both genera. In many respects it is even closer to *Diodontolepis* Wheeler, but the latter is much larger, with a different sculpture, All these genera have the maxillary palpi with six, and the labial palpi with four segments.

Pseudonotoncus hirsutus, sp. nov.

(Pl. IV, fig. 23–24.)

Worker.—Length, 3.3–3.8 mm.

Chocolate brown; antennae and legs somewhat lighter; gaster black.

Shining. Mandibles finely striate, clypeus striate-rugose. Head finely striate-reticulate, scapes very finely reticulate. Pronotum and mesonotum coarsely and irregularly rugose. Dorsum and declivity of epinotum transversely striate, the striae continued longitudinally on sides. Top of node rugose, anterior face smooth and shining, posterior face weakly striate transversely. Gaster smooth and shining.

Hair yellow, long, slender and erect, abundant throughout, shorter and suberect on antennae and legs. Pubescence very fine, sparse, apparent only on gaster.

Head very slightly broader than long, broader behind than in front, sides and occipital border feebly convex, angles broadly rounded. Mandibles furnished with six strong sharp teeth, the first, second and fourth largest. Clypeus convex in front, carinate above, the apex forming a sharp tooth-like projection in front. Frontal area large, transversely triangular. Frontal carinae as long as broad in front, one-third broader behind, sharply margined. Scapes extending beyond occipital border by almost one-fourth their length; first segment of funiculus twice as long as two following together, second to ninth longer than broad, tenth as long as broad, apical pointed, as long as two preceding together. Eyes large, convex, placed near posterior third of sides. Ocelli small. Thorax one and two-thirds times longer than broad. Pronotum twice as broad as long, strongly convex. Mesonotum as long as broad, sides almost straight, very feebly convex; a wide constriction separates epinotum. The latter broader than long, terminating in two long sharp spines, as long as their distance apart, almost parallel; two shorter, but sharp, teeth on lateral borders of declivity, wider apart than those on dorsum. In profile pronotum and mesonotum form a strong convexity, interrupted at suture. Meso-epinotal suture deeply impressed. Epinotum slightly convex, the spines slender, one-third shorter than dorsum, directed upward and backward, declivity straight, twice as long as dorsum, with a strong sharp spine at basal third, thicker and shorter than dorsal spines. Node twice as broad as long, strongly convex in front, feebly convex behind, furnished above with two broad sharp-pointed spines, their outer edges convex; in profile almost twice as high

as long, very slightly longer at base than above, anterior face vertical, convex toward tip, posterior face feebly convex, inclined slightly forward, spines slender, but a little more robust than those of pronotum, directed backward and upward; a short blunt tooth on the ventral surface in front, directed forward. Gaster slightly longer than broad, front and sides strongly convex. Legs slender.

Female.—Length, 4.3 mm.

Colour and pilosity as in the worker. Sculpture much coarser. Head as broad as long, occipital border almost straight. Mandibles and clypeus as in worker. Scapes extending beyond occipital border by one-third their length. Eyes and ocelli slightly larger. Pronotum broader than long, angles broadly rounded. Mesonotum one-third broader than long, posterior border straight, parapsidal furrows distinct. Scutellum one-fifth broader than long, oval. Epinotum almost four times broader than long, posterior border with two short, broad, sharp-pointed teeth-like spines. In profile pronotum truncate in front, suture deeply impressed. Mesonotum and scutellum feebly convex above. Epinotum low, dorsum and declivity united, convex, spines of dorsum slender and sharp, as long as dorsum, directed slightly backward, spines of declivity short, sharp, placed just below middle of lateral border. Node one-fourth broader than long, oval, spines long, broad at base, sharp at apex, inner borders straight, outer borders convex; in profile twice as high as long, thickest at base, anterior and posterior faces convex, spines slender, directed backward and upward; a sharp blunt tooth in front below directed forward. Gaster slightly longer than broad. Legs robust.

Habitat.—Gellibrand.

A small colony under a log. On being disturbed they instantly rolled themselves up and lay motionless.

Genus PROLASIUS Forel 1892.

Prolasius abruptus, sp. nov.

(Pl. IV, fig. 25.)

Worker.—Length, 3.5 mm.

Ferruginous; mandibles, antennae and legs lighter; gaster brownish.

Subopaque, very finely and densely punctate. Mandibles finely striate.

Hair yellow, long, slender and erect, almost confined to gaster, clypeus, mandibles and apex of scapes. Pubescence greyish, very fine, adpressed, abundant throughout but not hiding the sculpture.

Head very slightly longer than broad, sides and occipital border convex, angles broadly rounded. Mandibles triangular, with six large sharp teeth. Clypeus not carinate, bluntly pointed in front. Frontal area transversely triangular. Frontal carinae short, barely as long as broad in front, parallel. Scapes extending beyond occipital border by barely half their length; first segment of funiculus twice as long as two following together, second and third as long as broad, fourth to tenth longer than broad, apical as long as two preceding together. Eyes large, circular, rather flat, placed at middle of

sides. Ocelli present, but small. Thorax one and two-thirds longer than broad, sutures well defined. Pronotum almost twice as broad as long, strongly convex. Mesonotum almost one-fourth longer than broad, half as broad as pronotum, sides feebly convex. Epinotum one and one-half times broader than long; in profile pronotum and mesonotum convex, latter somewhat higher. Epinotum much lower than mesonotum, straight, elevated behind, declivity face straight, at right angles to dorsum, two and a half times as long as dorsum. Node scale-like, concave transversely; in profile the anterior face convex, posterior almost flat, a short broad projection below. Gaster one-fourth longer than broad. Legs slender.

Habitat.—Gellibrand, in rotten logs.

Prolasius pallidus, sp. nov.

(Pl. IV, fig. 26–27.)

Worker.—Length, 2.2–2.8 mm.

Pale ochraceous yellow; gaster slightly darker.

Hair yellow, short and erect, apparent only on clypeus and gaster. Pubescence yellow, very fine and adpressed, abundant throughout but not hiding the sculpture.

Head very slightly longer than broad, sides and occipital border convex, latter with a feeble indention at middle. Mandibles triangular, furnished with four large sharp teeth and three smaller. Clypeus produced to a blunt point in front, not carinate. Frontal area transversely triangular. Frontal carinae short, parallel. Scapes extending beyond occipital border by one-fourth of their length; first segment of funiculus slightly longer than two following, second and fourth as long as broad, third shortest, one-third broader than long, fifth to ninth longer than broad, tenth as long as broad, apical longer than two preceding together. Eyes moderately large and convex, placed at middle of sides. Ocelli small. Thorax one and two-thirds broader than long. Pronotum one-third broader than long, strongly convex; pro-mesonotal suture sharply impressed. Mesonotum as long as broad, broader in front than behind, sides and dorsum convex. Epinotum as long as broad, sides feebly convex. In profile the pronotum and mesonotum form an almost even convexity, dorsum of epinotum straight and inclined upward behind, epinotal declivity straight, or feebly convex, almost at right angles to dorsum, twice as long as dorsum. Node scale-like, bluntly pointed above, convex transversely, anterior face convex, posterior almost flat. Gaster almost twice as long as broad. Legs slender.

Female.—Length, 5.5 mm.

Colour, sculpture and pilosity as in the worker. Head slightly broader than long, sides feebly convex, occipital border feebly concave in middle, angles broadly rounded. Mandibles as in worker. Anterior two-thirds of clypeus carinate, produced somewhat tooth-like on the anterior border. Scapes extending beyond occipital border by one-fifth of their length. Eyes and ocelli large and convex. Thorax one and one-half times longer than broad. Pronotum hardly visible from above. Mesonotum one and one-half times broader than long, strongly convex in front; parapsidal furrows fully half as long as dorsum, sharply impressed. Scutellum one-fourth broader than long, oval. Epinotum five times broader than long. Node with a slight excision on top edge.

Habitat.—Beech Forest, under logs.

Prolasius hemiflavus, sp. nov.

(Pl. IV, fig. 28–29.)

Worker.—Length, 2.7–3.2 mm.

Head, thorax, node, antennae and legs ochraceous; gaster brownish; apex of segments yellowish.

Smooth and shining; head, thorax, antennae and legs very finely and densely punctate.

Hair yellow, sparse, rather long, erect and bristle-like; none on antennae and legs. Pubescence whitish, very fine and adpressed, hardly apparent on gaster.

Head almost one-fourth longer than broad, sides strongly convex, occipital border straight or feebly concave. Mandibles triangular, furnished with six strong sharp teeth. Clypeus strongly convex, not carinate, anterior border rounded. Frontal area large, broadly triangular. Frontal carinae as long as broad in front. Scapes extending beyond occipital border by almost one-third their length; first segment of funiculus larger than three following together, second and fourth as long as broad, third shorter, remainder longer than broad. Eyes large, placed at middle of sides. Ocelli prominent. Thorax barely twice as long as broad, sutures deeply impressed. Pronotum fully one-fourth longer than broad, sides straight. Epinotum broader than mesonotum, broader behind than in front, fully one-third broader than long, posterior border concave, sides convex. In profile the pronotum and mesonotum form a single convexity, mesonotum low, dorsum straight, epinotal declivity twice as long as dorsum, convex, the superior angle sharp. Node scale-like, bluntly pointed, convex transversely. Gaster one-fourth longer than broad. Legs rather long and slender.

Female.—Length, 4.4 mm.

Colour, sculpture and pilosity as in the worker. Head as broad as long, much broader behind than in front. Front edge of clypeus more acute than in worker, dorsum subcarinate in front. Scapes extending beyond occipital border by fully one-third their length. Thorax barely one-third broader than long. Pronotum short. Mesonotum one-third broader than long, dorsum flattened, parapsidal furrows not deeply impressed. Epinotum four times broader than long. Node scale-like as in worker.

Habitat.—Beech Forest.

This species is very common, being present in most rotten logs.

Prolasius niger, sp. nov.

(Pl. IV, fig. 30.)

Worker.—Length, 3.4–3.8 mm.

Black; mandibles, antennae and tarsi brown; legs blackish brown.

Smooth and shining. Mandibles feebly striate and punctate. Clypeus microscopically reticulate. Scapes and legs very finely and densely punctate.

Hair yellow, long and erect, very sparse on head, more numerous on gaster, not apparent on thorax, node, antennae and legs. Pubescence very fine and adpressed, sparse on body, abundant on antennae and legs.

Head very slightly longer than broad, almost square, sides and occipital border feebly convex, angles broadly rounded. Mandibles triangular, furnished with six strong sharp teeth. Clypeus sharply carinate on anterior two-thirds. Frontal area transversely triangular. Frontal carinae longer than broad in front, almost parallel. Scapes extending beyond occipital border by half their length ; first segment of funiculus twice as long as broad and slightly longer than second, remaining segments longer than broad, apical twice as long as broad, sharply pointed. Eyes circular, rather flat, placed slightly behind middle of sides. Ocelli very small. Thorax twice as long as broad. Pronotum one-fourth broader than long, strongly convex, twice as broad as rest of thorax. Mesonotum one-fourth longer than broad, sides almost straight. Epinotum as long as broad, broader behind than in front ; in profile the pronotum and mesonotum form a long convexity with a slight depression at the suture. Meso-epinotal suture deeply excised, epinotum convex, dorsum projecting slightly beyond the declivity face, hardly overhanging ; declivity face straight to near top where the projecting dorsum gives a concave appearance, almost one-third longer than dorsum. Node scale-like but twice as broad as long, very blunt above, convex transversely ; in profile, the anterior face strongly convex, posterior feebly convex, twice as high as long. Gaster one-fourth longer than broad. Legs slender.

Habitat.—Beech Forest, in rotten logs.

Prolasius flavicornis, sp. nov.

(Pl. IV, fig. 31–32.)

Worker.—Length, 3–4 mm.

Brownish-black ; antennae and coxae yellowish ; legs and node brown.

Shining, microscopically punctate throughout. Mandibles very finely striate longitudinally.

Hair yellow, long and erect, sparse throughout except on gaster. Pubescence very fine, short, sparse except on antennae and gaster.

Head very slightly longer than broad, sides and occipital border strongly convex. Mandibles triangular, furnished with five strong, sharp teeth behind the apex. Clypeus produced and bluntly pointed in front, subcarinate on anterior two-thirds above. Frontal area broad, almost convex behind. Frontal carinae barely as long as wide in front. Eyes large, convex, placed behind the middle of sides. Ocelli very small. Scapes extending beyond occipital border by almost half their length ; first segment of funiculus as long as the three following together, second to fourth as broad as long, remainder longer than broad, pronotum one-third broader than long, strongly convex. Mesonotum half as wide as pronotum, one-fourth longer than broad, slightly broader in front than behind, sides almost straight. Epinotum one-fourth narrower than pronotum, twice as broad behind as in front. In profile the pronotum and mesonotum together feebly convex, a deep and wide excision between mesonotum and epinotum, the latter dome-shaped, the declivity abrupt and straight, almost one-third longer than dorsum. Node scale-like, two and a half times higher than long, anterior and posterior faces convex, top edges straight and rather sharp. Gaster ovate. Legs robust.

Female.—Length, 5 mm.

Head and antennae ferruginous; thorax darker; gaster black with apical margin of segments reddish; legs ochraceous. Sculpture and pilosity as in the worker.

Head broader than long, much broader behind than in front. Mandibles and clypeus as in worker. Scapes extending beyond occipital border by one-third their length. Eyes and ocelli large and convex. Mesonotum flattened above, parapsidal furrows short but sharply impressed. Top edge of node concave. Gaster large.

Habitat.—Beech Forest; usually found under stones in damp fern gullies.

Genus STIGMACROS Forel 1905.

Stigmacros barretti Santschi.

Bull. Soc. Vaud. Sc. Nat. 56, no. 221, 1928, p. 477, fig. 2.

A single worker taken at Gellibrand. Originally described as from Ringwood (Barrett).

Genus CAMPONOTUS Mayr 1861.

Subgenus TANAEMYRMEX Ashmede 1905.

Camponotus (*Tanaemyrmex*) *consobrinus* (Erichson).

This common and widely distributed species was found at Gellibrand.

Having examined many large series of all forms of this species from all parts of Tasmania and the mainland I can find nothing in which to justify the retention of Roger's name, The differences in the clypeus and size mentioned by Roger for *dimidiatus* are found in all series of *consobrinus* from Tasmania.

CAMPONOTUS (TANAEMYRMEX) CONSOBRINUS Erichson, Arch. f. Naturg. viii, pt. i, p. 228, 1842, ♀ (*Formica*); Smith, Cat. Hymn. Brit. Mus. vi, p. 41, 1858, ☿ ♀. (*Formica*).

Camponotus consobrinus Froggatt, Agric. Gaz. N.S. Wales, 1905.

Camponotus consobrinus Roger, Verz. Formicid, p. 4, 1863 (non Erichson); Emery, Genera Insect. fasc. 183, p. 171, 1925 (sous genre incertain).

Camponotus dimidiatus Roger, Verz. Formicid, p. 4, 44, 1863, ☿; Mayr, Reise Novara, Formic. p. 50, 1865, ☿.

Camponotus nigriceps var. *dimidiatus* Emery, Ann. Mus. Stor. Nat. Genova, xxiv, p. 211, 1887, ☿ ♀ ♂.

Camponotus nigriceps s. sp. *dimidiatus* Forel, Arkiv. f. Zool. ix, (16), p. 97, 1915.

Camponotus intrepidus Mayr, Verh. Zool.-bot. Ges. Wien, xii, p. 659, 1862 (non Kirby).

s. sp. LIVIDIPES Emery, Ann. Mus. Nat. Genova, xxiv, p. 211, 1887 (nota). (*Camponotus nigriceps* var. *lividipes* Emery.)

Camponotus nigriceps var. *prostans* Forel, Fauna S.W. Austrl. i, p. 301, 1907, ♀ ; Rev. Suisse Zool. xviii, p. 72, 1910 ; Emery, Gen. Insect. 183, p. 103, 1925.

s. sp. OBNIGER Forel.

Camponotus nigriceps var. *obniger* Forel, Rev. Suisse Zool. x, p. 506, 1902, ♀ ; Forel, ibidem, xviii, p. 72, 1902 ; Emery, Gen. Insect. 183, p. 103, 1925.

s. sp. PERTHIANA Forel, Arkiv. f. Zool. ix (16), p. 97, 1915, ♀ ; Crawley, Ann. Mag. Nat. Hist. (9), x, p. 35, 1922, ♀ ♀ ; Emery, Gen. Insect. 183, p. 103, 1925.

CAMPONOTUS (TANAEMYRMEX) NIGRICEPS F. Smith, Cat. Hymn. Brit. Mus. vi, p. 38, 1858, ♀.

Camponotus nigriceps Roger, Verz. Formicid, p. 4, 1863, ♀. Mayr, Verh. Zool.-bot. Ges. Wien, xii, p. 59, 63, 1876, ♀ ♀.

Camponotus (*Myrmoturba*) *nigriceps* Forel (1914).

Camponotus (*Tanaemyrmex*) *nigriceps* Emery, Gen. Insect. 183, p. 103, 1925.

s. sp. CLARIOR Forel, Rev. Suisse Zool. x, p. 506, 1902, ♀. (*nigriceps* var.). Emery, Gen. Insect. 183, p. 103, 1925.

s. sp. PALLIDICEPS Emery, Ann. Mus. Nat. Genova, xxiv, p. 211 (nota), 1887. (*nigriceps* var.)

Subgenus MYRMOSAULUS Wheeler 1921.

Camponotus (*Myrmosaulus*) *intrepidus* (Kirby).

Trans. Linn. Soc. Lond. xii, p. 477, 1818 (*Formica*).

Formica agilis Smith, Cat. Hymn. Brit. Mus. vi, p. 37, 1858.

Camponotus intrepidus Roger, Verz. Formicid, p. 4, 1863 ; Mayr, Jour. Mus. Godeffroy, xii, p. 62, 1876 ; Forel, Rev. Suisse Zool. x, p. 493, 1902 (sensu strict).

Camponotus magnus Mayr, Verh. Zool.-bot. Ges. Wien, xii, p. 673, 1863.

Camponotus (*Myrmosaulus*) *intrepidus* Emery, Gen. Insect. 183, p. 114, 1925.

One nest of this species was found at Gellibrand, nesting under a rotten log.

Subgenus MYRMOPHYMA Forel 1912.

Camponotus (*Myrmophyma*) *aeneopilosus* Mayr.

Verh. Zool.-bot. Ges. Wien, xii, p. 665, 1862.

Two specimens found running on bush track at Gellibrand.

Camponotus (*Myrmophyma*) *hartogi* Forel.

Rev. Suisse Zool. x, p. 500, 1902, ♀.

Camponotus (*Myrmepomis*) *hartogi* Forel (1914).

Camponotus (*Myrmophyma*) *hartogi* Emery, Gen. Insect., fas. 183, p. 111, 1925.

Several small nests of this species were found at Gellibrand.

Genus POLYRHACHIS Smith 1857.

Subgenus CAMPOMYRMA Wheeler 1911.

Polyrhachis (*Campomyrma*) *femorata* Smith.

Cat. Hymn. Brit. Mus. vi, p. 73, pl. 4, fig. 46, 1858, ♀.

Polyrhachis femorata Mayr, Jour. Mus. Godeffroy, xii, p. 70, 76, 1876, ♀.

Camponotus emeryi Forel, Bull. Soc. Vaud. Sc. Nat. xvi, p. 113, pl. 1, fig. 4, 1879.

Polyrhachis (*Campomyrma*) *femorata* Forel, Arkiv. f. Zool. ix (16), p. 113, 1915; Emery, Gen. Insect. 183, p. 179, 1925.

Several nests were found under logs and stones at Gellibrand.

Polyrhachis (*Campomyrma*) *semipolita* Andre.

Rev. d'Ent. Caen, p. 251, 1896 (*P. semipolita*).

Polyrhachis (*Campomyrma*) *hexicantha* s. sp. *semipolita* Emery, Gen. Insect. 183, p. 179, 1925.

A nest of this distinct species was found under a log near Gellibrand River.

Genus PARATRECHINA Motschoulsky 1863.

Subgenus Nylanderia Emery 1906.

Paratrechina (*Nylanderia*) *obscura* Mayr.

Ver. Zool.-bot. Ges. Wien, xii, p. 698, 1862.

Two nests of this species were found at Gellibrand.

Paratrechina (*Nylanderia*) *minutula* Forel.

Mitt. Zool. Mus. Berlin, 2, p. 25, 1901, ♀.

A small colony under a log at Gellibrand.

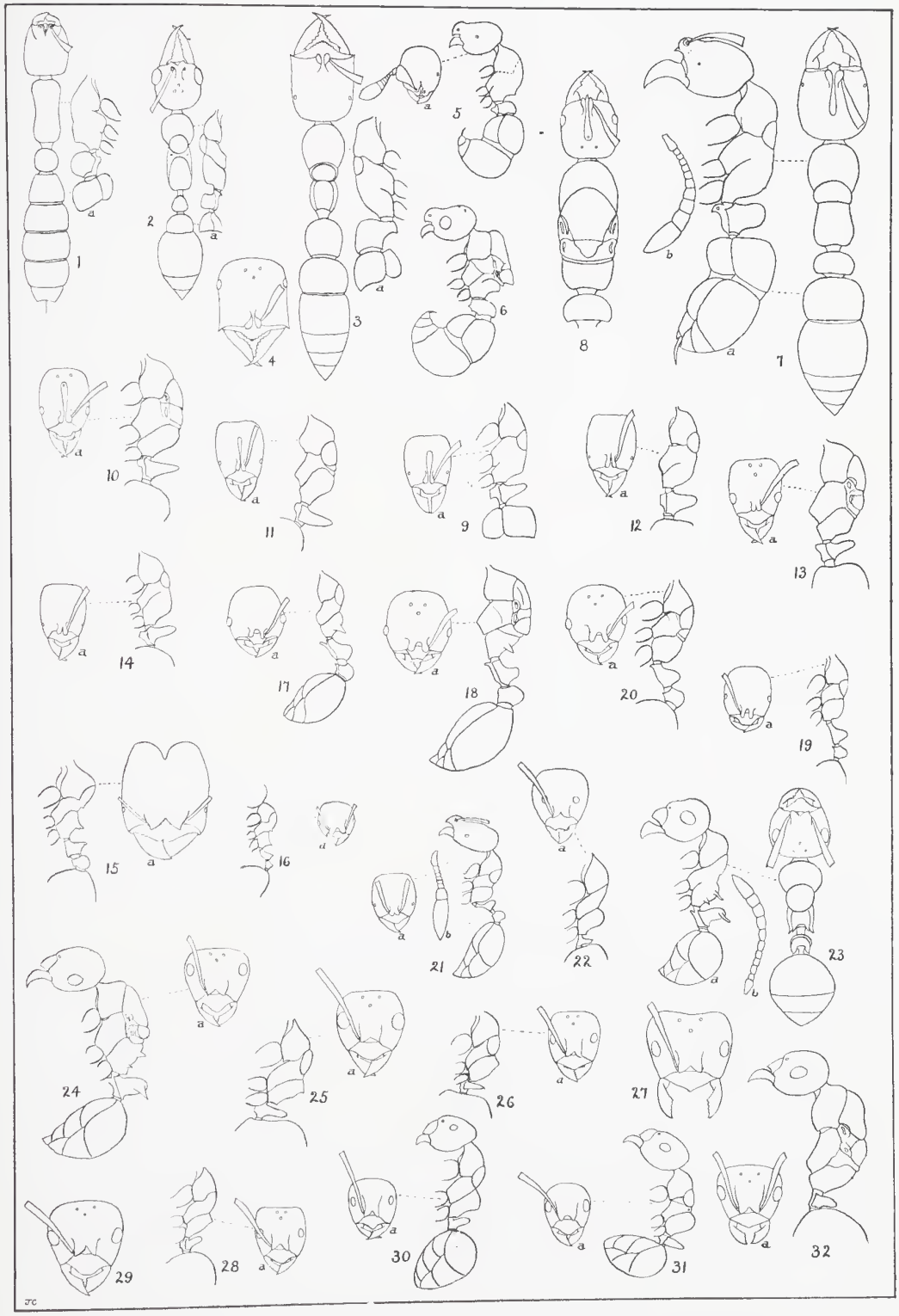
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Plate IV

Fig.

1. *Eusphinctus fulvipes*, sp. nov. ; worker.
2. *Myrmecia crassinoda*, sp. nov. ; worker.
3, 4. *Amblyopone* (*Fulakora*) *gracilis*, sp. nov. ; worker (3) ; head of female (4).
5, 6. *Discothyrea turtoni*, sp. nov. ; worker (5) ; female (6).
7, 8. *Trapeziopelta diadela*, sp. nov. ; worker (7) ; female (8).
9, 10, 11. *Ponera scitula*, sp. nov. ; worker (9) ; female (10) ; ergatoid female (11).
12, 13. *P. decora*, sp. nov. ; worker (12) ; female (13).
14. *P. rectidens*, sp. nov. ; worker.
15, 16. *Pheidole gellibrandi*, sp. nov. ; soldier (15) ; worker (16).
17, 18. *Monomorium* (*Notomyrmex*) *sculpturatum*, sp. nov. ; worker (17) ; female (18).
19, 20. *M.* (*N.*) *hemiphaeum*, sp. nov. ; worker (19) ; female (20).
21. *Solenopsis fusciventris*, sp. nov. ; worker.
22. *Iridomyrmex vicina*, sp. nov. ; worker.
23, 24. *Pseudonotoncus hirsutus*, sp. nov. ; worker (23) ; female (24).
25. *Prolasius abruptus*, sp. nov. ; worker.
26, 27. *P. pallidus*, sp. nov. ; worker (26) ; head of female (27).
28, 29. *P. hemiflavus*, sp. nov. ; worker (28) ; head of female (29).
30, 31. *P. flavicornis*, sp. nov. ; worker (30) ; head of female (31).
32. *P. niger*, sp. nov. ; worker.

A REVISION OF THE AUSTRALIAN JERBOA MICE.

C. W. Brazenor, National Museum.

Plates V, VI, and VII.

The following revision of Australian Jerboa Mice is based on detailed examination of 140 specimens in the National Museum, Melbourne, and 35 in the Western Australian Museum, Perth, for the loan of which I am indebted to Mr. L. Glauert, B.A., F.G.S., Curator.

Identification of species is by no means simple since they closely resemble one another and published diagnostic descriptions are often inadequate.

The skulls of all are strikingly similar, and some minor variations are certainly not constant specifically.

For instance Oldfield Thomas (4) states that the mesopterygoid fossa of *cervinus* is broadened in front, but according to Wood Jones (8) the mesial pterygoid processes of *cervinus* are "practically straight": in the present series both shapes are found (see fig. 1). In describing *fuscus*, Wood Jones (8)

Fig. 1. Variation of mesopterygoid fossae in *N. cervinus* (Gould).

says "the skull differs from that of *cervinus* in possessing palatal foramina which do not extend backwards past the anterior edge of the first molar tooth." Eight skulls of *cervinus* were examined for this character; in three the palatal foramina extend past the outer edge of M^1, in three others they reach as far as this point, and in two they do not reach it.

All available skulls of various species were arranged in sequence according to the width of the palatal foramina, from the most open to the most closed; the result was a meaningless jumble.

Such characters are therefore not reliable, and, though not without regret, they have been discarded in this paper.

The angle of inclination of incisor teeth for any one species is also variable. Oldfield Thomas records this angle in his diagnoses of the various species as the "incisive index," but he

did not define the meaning of the term nor explain his method of measurement. For this reason the angles of inclination of incisor teeth in all available specimens were measured during this investigation on a definite system and the results are noted. "Index of incisors" or "incisor index" used in this paper is the angle between two lines, one drawn through the centre of the external auditory meatus to the most anterior point where, in a true profile, the incisor joins the alveolar border; and the other from the latter point through the cutting edge of the tooth. (Fig. 2.)

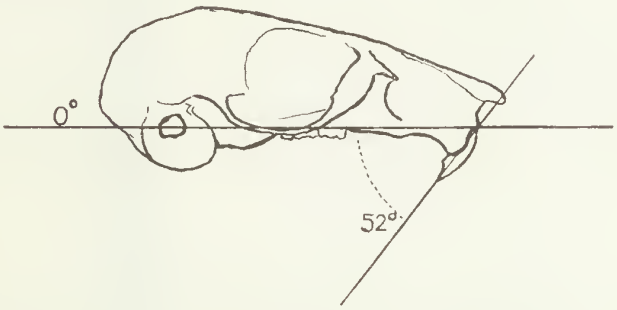

Fig. 2. Angle quoted as index of incisors.

Ears are measured from the notch at the base of the concha to the extreme tip of the ear. These and other measurements are tabulated at the end of the paper.

Ridgway's system for names of colours is used (*Colour Standards and Nomenclature*).

All Australian Jerboa Mice, together with other Australian rodents, were included in the genus *Hapalotis* (Lichtenstein, 1829) until 1892, when J. D. Ogilby (1) found that the name was pre-occupied; he therefore replaced it by *Conilurus*, a name proposed by W. Ogilby in 1838. In 1898, E. R. Waite (2) in describing material collected on the Horne Expedition, separated the Jerboa Mice from the genus *Conilurus* on account of the specialisation of the pes, and erected two new genera, *Thylacomys* and *Podanomalus*, based on the presence or absence of a gular pouch; he described the pouch as a rather shallow depression lined with fine hair, with the lower border thickened and of —·— shape. Waite (3) found that *Thylacomys* was a pre-occupied name and changed it in 1900 to *Ascopharynx*. Oldfield Thomas (4) in 1906 revised the classification and he was not prepared to accept the generic importance of the gular pouch; at the same time he revived the name *Notomys* (Lesson, 1842). In 1921, in revising the genus *Notomys*, he said (6) that the throat-pouch described by Waite would seem to be a skin-gland. Wood Jones (8) in 1925 reinstated Waite's name,

Ascopharynx, for pouched forms; in a later paper (9) he described the gular pouch as a little skin pocket, lined by thick hairs, which is situated on the ventral surface of the neck and opens forwards.

Examination of the National Museum material shows that the gular pouch is lined with specialised solid hair quite unlike the normal body hair (fig. 3). In some of the pouchless forms

a. *b.*

Fig. 3. Hair of *N. cervinus*: *a* from gular glandular area, *b* from chest.

the same part of the gular area is clothed with a patch of similar solid hairs, indicating a like glandular structure; this is confirmed by G. Bourne's investigation of the microscopic structure published in this Memoir. The expression "gular pouch" has therefore been discarded in this paper in favour of "gular glandular area." All species with a gular glandular area are placed in the genus *Notomys*.

Two species examined have no gular glandular area, but the male (and not the female) has an oval, slightly swollen pre-sternal gland between the fore-legs. No trace of a pre-sternal gland was found in any specimen having a gular glandular area. All species with a pre-sternal gland have been placed in the genus *Podanomalus*.

The fact that Thomas and Waite neither investigated the structure of the gular hair nor, apparently, discovered the chest-gland of *longicaudatus*, causes rather an involved situation in synonomy; it is clear, however, that Waite's *Podanomalus* has priority.

Family **MURIDAE** Grey 1821.

Subfamily **Murinae** Baird 1857.

Genus NOTOMYS Lesson.

Notomys, Less., N. Tabl. R. A. Mamm., p. 129, 1842; Thomas, Ann. Mag. Nat. Hist. (7), XVII, p. 83, 1906.

Thylacomys, Waite, Proc. Roy. Soc. Vict., X, p. 121, 1898 (nec Blythe, 1841).

Ascopharynx, Waite, Ann. Mag. Nat. Hist. (7), V, p. 223, 1900; Wood Jones, Rec. Sth. Aust. Mus., III, p. 1, 1925.

General characters murine. Teeth practically as in *Mus*, no posterior internal cusp on molars. Skull with anterior edge of zygoma root deeply concave. Hind feet lengthened, pads reduced to three or four. Tail long; basal half with short hairs, not clothed sufficiently to hide scales, distal half with gradually lengthening hairs toward the pencilled tip. Gland on throat sharply defined by solid, silvery hair, quite distinct from the normal hair.

Genotype . . . *N. mitchelli* Og.

Notomys gouldi (Gould).

Hapalotis gouldi, Gray, Grey's Journal, II, Append., p. 404, 1841 (nomen nudum); List Mamm. Brit. Mus., p. 116, 1843 (nom. nud.).

Hapalotis mitchelli, Gould, Mamm. Aust. III, pl. IX, 1845, W. Aust., nec *Dipus mitchelli*, Ogil.

Hapalotis gouldi, Gould, Pro. Zoo. Soc., 1851, p. 127 (nom. nud.); Mamm. Aust., III, Introd., p. XXXV, 1863.

Hapalotis richardsoni, Gray, Voy. "Erebus" and "Terror," Mamm., p. 12d, pl. XXVIII, fig. 2, 1875.

Notomys gouldi, Thomas, Pro. Zoo. Soc., 1906, p. 767; Ann. Mag. Nat. Hist. (9), VIII, p. 538, 1921.

Large, comparatively thinly haired. General colour between buffy- and olive-brown. Dorsal fur (11.5 mm.), slate for three-fourths of length, then cinnamon buff with dark tips, slate of base showing through and imparting a cool tone. Sides of body lighter, dark tips being less pronounced. Cheeks lighter, upper lip almost white. Ear long and oval in outline; outer surface sparsely clothed with short, fine, brown hairs, inner surface with silvery adpressed hairs, most numerous round edges. Chin and throat clothed with silky, silvery hair, white to base in sharp contrast with remainder of ventral fur. Ventral surface of body greyish white, hairs basally grey with white tips, the grey showing through. Tail brown above, white below; extreme tip uniformly clothed with dark hairs (15 mm.). Manus and pes sparsely covered with silvery hairs, which form fringe round distal pads. Pes slender (4.5 mm. at base of toes 2.3.4.), hallux small. Four pads; hallucal distinctly raised in 8 specimens, less so in remainder.

Skull.—For size of animal, small and slender in build, with narrow muzzle and small bullae (ant.-post. length two-thirds of diastema).

Teeth.—Index of incisors 50°–58°.

Habitat.—West Australia.

Type.—In British Museum.

Fifteen specimens examined; Champion Bay, King George's Sound, Ongerup, unspecified localities, W.A.; (?) Ooldea, S.A. Nat. Mus. Nos. R1765–6, R1106, C5–9.

Except for a few specimens no precise localities are preserved, the majority being labelled "West Australia." A specimen from the West Australian Museum collection is reputed to be from Ooldea, South Australia, but it is possible that this may be in error.

N. gouldi stands out from among the remainder of the genus by reason of its larger size and cool colour, and by its slender feet, on which the hallux is very much smaller, comparatively, than that of any other species.

Notomys macrotis Thomas.

Hapalotis macrotis, Gerrard, Cat. Bones Mamm. B.M., p. 171, 1872 (nom. nud.); Gould, Mamm. Aust., Introd., p. XXXV, 1863 (nom. nud.).

Notomys macrotis, Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 538, 1921.

Thomas' description is as follows. "Similar to *N. gouldi*, but larger, the hind foot about 40 mm., the skull some 2 or 3 mm. larger than in that animal. Fur rather coarser. Colour apparently similar. Interorbital space comparatively broad. Palatal foramina large, open, about 2.6 mm. in breadth as compared to 1.8 mm. in *gouldi*. Choanae also markedly broader, nearly 3 mm. in breadth. Orthodont; incisive index of type 68°. . . Habitat. Interior of Western Australia, on Moore's River."

No specimen in the series examined can be attributed to *N. macrotis*. Though many approach, and some equal, in size, the type of that species, none is "readily distinguishable by its large and open palatal foramina," nor do any approach in incisor index the 68° of the type's "incisive index."

Moore's River can scarcely be called the "interior of West Australia." It is a small river some 60 miles north of Perth.

Notomys mitchelli (Ogilby).

Dipus mitchelli, Ogilby, Trans. Linn. Soc., XVIII, p. 130, 1841.

Notomys mitchelli, Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 539, 1921; id. Ann. Mag. Nat. Hist. (9), IX, p. 315, 1922; Wood Jones, Rec. Sth. Aust. Mus., III, p. 3, 1925; id. Mamm. Sth. Aust., III, p. 339, 1925.

Medium sized. General colour tawny-olive, darker on mid-dorsal line. Individual hairs (14 mm.) slate for a little more than half length, then tawny with dark tips, the latter becoming more pronounced towards tail. Sides of body lighter, cheeks lighter, upper lip white. Ears long, tips bluntly pointed, outer surface sparsely covered with dark-brown hairs, inner surface with silvery, adpressed hairs. Gular glandular area defined by silky white, solid

hair. Ventral surface and inner side of limbs greyish-white ; basally grey with the distal half white. Tail brown above, white below to tip. Manus and pes silvery white. Pes comparatively stout (4 mm. at base of toes 2.3.4.). Four pads ; hallucal pad much more clearly defined in some specimens than in others, but in all at least an indication is present.

Skull.—Large ; muzzle comparatively heavy, generally with open palatal foramina. Bullae medium (ant.-post. length three-fourths of diastema).

Teeth.—Index of incisors 53°–60°.

Habitat.—Southern portion of the Australian Continent.

Type.—In Australian Museum, Sydney.

Thirty-seven specimens examined ; Murray River, Vict. ; Ooldea, S.A. ; Balladonia, Bencubbin, Gibson, L. King, W.A. Nat. Mus. Nos. R1767, C10–35.

The series examined consists principally of specimens collected by Blandowski on the River Murray in 1857 ; in all of these the occipital region of the skulls, including the bullae, has been cut away. A small series of recent specimens practically identical with the above was loaned for examination, with others, by the Western Australian Museum. Mr. E. Le G. Troughton kindly compared two Blandowski specimens with Mitchell's original material from near the junction of the Murray and Murrumbidgee Rivers described by Ogilby in 1841 and preserved in the Australian Museum, Sydney ; he considers that they are quite typical.

Notomys mitchelli macropus Thomas.

Notomys mitchelli macropus, Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 540, 1921 ; Wood Jones, Mamm. Sth. Aust., III, p. 341, 1925.

A long haired, pale race, with foot slightly longer and stouter than in typical *mitchelli*. General colour between avellaneous and wood-brown, but darkened on mid-dorsal surface by a heavy grizzling of dark tipped hairs. Dorsal fur (18 mm.) slate for two-thirds of length, then pallid with dark tips. Sides of body lighter, upper lip white. Ear long ; more truly oval than in typical *mitchelli ;* hair on outer surface same colour as on body. Gular glandular area as in *mitchelli*. Ventral surface white, hairs basally grey for a little less than half length. Tail greyish-brown above, white below. Manus and pes white. Pes stout (5 mm. at base of toes 2.3.4.). Hallucal pad present.

Habitat.—South-eastern South Australia and Victoria.

Type.—In British Museum.

One specimen only examined, taken in 1914 in the northern Mallee, Victoria. The skull is crushed, and, unfortunately, cannot be removed from the skin. Nat. Mus. No. R5938.

Notomys mitchelli alutacea subsp. nov.

A long-haired, reddish form, in which basal part of dorsal hair (17 mm.) is tinged with a vinaceous hue, being faded brown rather than grey. Subterminal band cinnamon, tipped with Prout's brown. Sides of body, crown, and cheeks

lighter, upper lip white. Ears bluntly pointed at tips; outer surface with numerous fine russet hairs, inner surface with a few silvery hairs at tip. Gular glandular area well defined; clothed with solid, silky hair. Ventral surface yellowish-white, hairs basally a faded brownish-grey. Tail russet-brown above, white below to tip. Manus and pes white. Pes heavy (4.5 mm. at base of toes 2.3.4.). Hallucal pad present.

Skull.—Similar to *mitchelli*; large and heavy.

Teeth.—Index of incisors 50°–56°.

Habitat.—Central South and Southern West Australia.

Type.—In National Museum, Melbourne, ♀, No. C38, from Ooldea, South Australia.

Dimensions of type (measured from spirit).—Head and body 98 mm.; tail 145 mm.; hind foot 37 mm.; ear 23 mm.

Skull.—Greatest length 32 mm.; basal length 25.5 mm.; greatest breadth 16 mm.; nasals 12 x 3 mm.; interorbital breadth 5.3 mm.; palate length 15 mm.; breadth outside $m.^2$ 6.5 mm.; breadth inside $M.^2$ 3.3 mm.; palatal foramina 5.8 x 1.8 mm.; diastema 7.3 mm.; upper molars 5 mm.

Ten specimens examined; Ooldea, S.A.; Central Australia; West Australia. Nat. Mus. Nos. C38-42.

Intensity of reddish colouration varies in the series of skins examined. The most deeply tinted specimen is reputed to be from West Australia, and taken in 1865. In this the basal half of the fur is a strong russet, as, to a lesser extent, is the general colour of the animal. The majority, however, have not this intensity of colour though they are warm in tone and lacking the ochraceous colouration of typical *mitchelli*.

Notomys alexis Thomas.

Notomys mitchelli Thomas (*nec* Ogilby), Proc. Zoo. Soc. Lond., 1906, p. 539; *id.*, Ann. Mag. Nat. Hist. (9), VIII, p. 539, 1921.

Notomys alexis Thomas, Ann. Mag. Nat. Hist. (9), IX, p. 317, 1922.

Ascopharynx fuscus Wood Jones, Rec. Sth. Aust. Mus., III, p. 3, 1925; *id.* Mamm. Sth. Aust., III, p. 344, 1925.

Short-haired. General colour sayal-brown; much more uniform and less grizzled than in any other species examined. Dorsal fur (11 mm.) slate for about basal half, then cinnamon with darker tips. Cheeks and upper lip white. Ears comparatively short; tips bluntly pointed; outer surface with a few brown hairs, inner surface with a few silvery hairs. Gular glandular area very variable, some specimens having a well-formed fold of skin along posterior border forming a pouch, others simply a flat area; between these extremes are intermediate stages. Basal colour of hair on ventral surface white to base on anterior portion of body, grey basally on posterior portion; in some specimens the basal grey is a very light tint and confined to inner side of hind limbs; in others a darker grey extends to lower chest. Tail brown above, white below; tip not as bushy as in other species. Manus and pes white. Pes comparatively stout (4 mm. at base of toes 2.3.4.). Pads either three or four, the hallucal being present in slightly less than half the number examined.

Skull.—Bullae medium. About four-fifths of diastema.

Teeth.—Index of incisors 52°–58°.

Habitat.—Central, Northern and North Western Australia.

Type.—In British Museum.

Fifty-six specimens examined; Alroy, Tennant's Creek, Tanami, Reedy Creek, Alice Springs, Northern Territory; Townsend Range, wells on Canning Stock Route, Western Australia. Nat. Mus. Nos. R12444, C43–80.

Three of the original Stalker series (skins) used by Thomas in erecting the species were loaned by the West Australian Museum.

The type is an "old female" and is large (head and body 106 mm.) in comparison with the great majority of specimens examined including the three Stalker specimens used by Thomas. The others are old alcoholic specimens and have probably shrunk slightly. The average head and body length of the series examined is about 95 mm., though several old females range up to 103 mm. Foot, tail, and ear measurements are reasonably constant throughout.

N. fuscus Wood Jones is placed in synonomy. I have not seen the type specimens of *fuscus*, but have examined the comprehensive series of animals taken during, or just after, the Horne Expedition, which contains a number of the "dark form" mentioned by Waite and by Wood Jones in his extended description of *fuscus*.

Oldfield Thomas entirely disregarded the peculiarities of the gular area when describing *alexis* in 1922, though when dealing with the same specimens in 1906 and 1921 as *mitchelli* (in error) he noted "a glandular organ on the throat."

Formerly *fuscus* (=*alexis*) was considered a dark variant of *cervinus*, but the shorter and less woolly fur, the shorter ears, and the basally grey abdominal fur of the species now under consideration rightly separate it. The colour range of the two species over-laps. A series may be so arranged that the colours grade uninterruptedly from pinkish-cinnamon (*cervinus*) to Saccardo's umber (*alexis*).

Notomys aquilo Thomas.

Notomys aquilo Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 540, 1921.

Thomas' description is as follows: "A small pale species with thin fur. Size slightly less than *mitchelli*.* Fur thin, poor, not woolly. General colour pale sandy brown above, white below, hairs white to their bases. A well-marked neck-gland present in the type. Feet thinly haired, flesh-coloured. Tail sandy brown, not conspicuously bicolour proximally. Skull delicately built. Interorbital region flat, more parallel-sided than usual, less quickly

*Later (1922) referred by Thomas to a new species, *alexis*.

broadening posteriorly. Lacrymal bones unusually large in the type, though this may be mainly due to age. Palatal foramina fairly large, well open. Anterior end of mesopterygoid fossae narrow, parallel sided. Molars small. Incisors more or less orthodont, index of type 70°. Habitat. Cape York, North Queensland."

Type.—In British Museum.

I have not seen the type of this species, but the description applies perfectly to some specimens of *N. alexis* except for two characters : basal colour of ventral fur and higher incisor index. The basal colour of the ventral fur varies in *alexis* as noted above. In some specimens basally grey fur is confined to the inner side of the hind limbs, and the colour is so pale that, in a dry skin, it is difficult to see ; if the skin be damped, however, it at once becomes apparent. The figure given by Thomas for the incisor index of the type *aquilo* is higher than that in any of the present series of *alexis* measured in the manner previously described in this paper ; for this reason alone, I have included his description. I have no doubt, however, that it will prove to be identical with *alexis*, whose distribution might reasonably be expected to extend to the dry areas south of Cape York. In this case *alexis*, which is the later species, would be consigned to the synonomy of *aquilo*.

Notomys cervinus (Gould).

Hapalotis cervinus Gould, Pro. Zoo. Soc., 1851, p. 127.

Thylacomys cervinus Waite, Pro. Roy. Soc. Vict., X, p. 117, 1898, Pl. VI.

Notomys cervinus Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 541, 1921.

Ascopharynx cervinus Wood Jones, Rec. Sth. Aust. Mus., III, p. 3, 1925 ; *id.* Mamm. Sth. Aust., III, p. 343, 1925.

Medium size, long-haired. General colour between cinnamon-buff and clay-colour, grizzled with dark-brown hairs more or less uniformly over dorsal surface. Individual hairs (14 mm.) slate for about half length, then buffy with darker tips. Sides of body lighter, forearms white. Cheeks and upper lip white. Ears long ; tips bluntly pointed ; outer surface lightly clothed with light-brown hair, inner surface with silvery hair. Gular glandular area well marked in all specimens, a fold of skin along posterior border forming a shallow pouch. Ventral surface and inner sides of limbs white, hairs white to base. Tail brown above, white below. Manus and pes silvery white. Pes medium (4 mm. at base of toes 2.3.4.). Pads three or four, the hallucal being present in 12, absent in 5 specimens examined.

Skull.—Bullae medium. More than three-fourths of diastema.

Teeth.—Index of incisors, 52°–58°.

Habitat.—Central and South Australia.

Type (lectotype).—In British Museum.

Seventeen specimens examined ; Charlotte Waters, Mulka, S.A. Nat. Mus. Nos. R12416–7, R12629, R13719–24, R13734–9, R13742–3.

Readily distinguishable from all other species I have seen by the wholly white ventral fur.

Notomys sturti Thos.

Notomys sturti Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 537, 1921.

Thomas' description is as follows: "A long-tailed species, rather smaller than *longicaudatus*. Proportions about as in *longicaudatus*, though the feet are relatively larger. Colour apparently about as in that species, but the only specimen has had the distal part of the fur singed off, so that the exact shade cannot be described. Feet very slender.

"*Skull* apparently similar to that of *longicaudatus*, but smaller in all dimensions. There is, however, no evidence as to the size of the bullae.

"*Habitat.*—Interior of New South Wales in the Lower Darling region. Type 'captured in the Coonbaralba Range about 85 miles from Laidley's Ponds'."

Type.—In British Museum.

I have not seen this specimen. It appears to be closely allied to *longicaudatus*, differing only by its slender feet, and therefore possibly should be placed in the genus *Podanomalus*.

Notomys mordax Thomas.

Notomys mordax Thomas, Ann. Mag. Nat. Hist. (9), IX, p. 317, 1922.

Thomas based this species on a skull as follows: "Size about as in *N. gouldi*, but the general build stouter throughout. External characters unknown. Skull broad, strongly built, with widely open anteorbital foramina and broad frontal region. Interorbital space comparatively broad. Palatal foramina long, well open, extending back past the anterior root of M.[1] Mesopterygoid fossa fairly broad, but not specially broadened anteriorly, its sides practically parallel. Bullae rather small for the bulk of the animal, though slightly larger than in *gouldi*; conspicuously smaller than in the large *longicaudatus*.

"Teeth large and heavy. Incisors orthodont, unusually broad and strong, as broad but not as deep as in *longicaudatus*, flatter and less bevelled in front.

"Habitat. Darling Downs, S. Queensland."

Type (Skull).—In British Museum.

I have not seen this skull.

Genus PODANOMALUS Waite.

Podanomalus Waite, Proc. Roy. Soc. Vict., X, p. 117, 1898.

General characters murine. Differs from *Notomys* mainly by the absence of a gular glandular area, and by the presence, in the male animal only, of an oval, slightly swollen pre-sternal gland directly between the forelegs.

Genotype . . . *P. longicaudatus* Gould.

Podanomalus longicaudatus (Gould).

Hapalotis longicaudatus Gould, Pro. Zoo. Soc., 1844, p. 104.

Hapalotis mitchelli Spencer (as of Ogilby), Report Horne Expdn., II, p. 10.

Podanomalus longicaudatus Waite, Pro. Roy. Soc. Vict., X, p. 117, 1897, Pl. V.

Notomys longicaudatus Thomas, Ann. Mag. Nat. Hist. (9), VIII, p. 537, 1921; Wood Jones, Rec. Sth. Aust. Mus., III, p. 2, 1925; *id.* Mamm. Sth. Aust., III, p. 338, 1925.

Large, heavily-built. General colour tawny-olive, a little darker on mid-dorsal line. Individual hairs (14 mm.) slate for more than half length, then cinnamon with dark brown tips. Cheeks lighter, upper lip white. Ears long; tips bluntly pointed; almost naked. Ventral surface greyish-white, hairs basally slate with greyish-white tips. On male only, an oval gland with raised margin between forelegs. Tail brown above, white below for basal half; then with gradually lengthening black hairs to tip; several specimens have a few white hairs at extreme tip. Manus brown, a little lighter than body. Pes white, heavy (6 mm. at base of toes 2.3.4.). Hallucal pad present in all specimens.

Skull.—Stout. Bullae large, almost or quite equal to diastema.

Teeth.—Index of incisors 60°–65°.

Habitat.—Central Australia.

Type (lectotype).—In British Museum.

Twenty-eight specimens examined; North of Alice Springs, Barrow Creek, Central Australia. Nat. Mus. Nos. R13817–21, R13216–24, C201, C266–268.

The largest of the Jerboa Mice; easily recognised by its size, or in young animals, by the length and heaviness of the pes. Specimens examined comprise seven taken on, or just after the Horne Expedition, and twenty-two taken at Barrow Creek on the Spencer–Gillen Expedition in 1901.

Podanomalus aistoni, sp. nov.

Pale, short-haired. General colour avellaneus, heavily grizzled with dark tipped hairs. Dorsal fur (11 mm.) slate for half its length, then pallid with dark tips. Sides of body lighter. Upper lip white. Ears long; tips bluntly pointed; very sparsely clothed with fine hairs, light brown on outer surface, silvery white on inner surface. Ventral surface and inner side of limbs white. Fur on chest and inner side of fore limbs white to base in some specimens; in others grey for basal half; abdominal region in all specimens basally grey. Oval gland on chest, between the forelegs, of male only. Tail brown above, white below. Manus and pes white. Pes with well-formed hallucal pad on all specimens.

Skull.—Comparatively shorter, and noticeably wider in the interorbital region, than the skull of any other of the Jerboa Mice. Bullae small (two-thirds of diastema).

Teeth.—Index of incisors 65°–67°.

Habitat.—Lake Eyre District, South Australia.

Type.—In the National Museum of Victoria, ♂, R13740, from Mulka, E. of Lake Eyre, S.A.

Dimensions of Type.—Head and body 104 mm.; tail 149 mm.; hind foot 35 mm.; ear 23 mm. (dry).

Skull.—Greatest length 29 mm.; greatest breadth 16 mm.; nasals 10.5 x 3 mm.; interorbital breadth 6.3 mm.; palate length 14.5 mm.; breadth outside $M.^2$ 7 mm.; breadth inside $M.^2$ 3.8 mm.; palatal foramina 5.3 x 2 mm.; diastema 7.8 mm.; upper molars 5 mm.

Fifteen specimens examined from the type locality, Mulka. Nat. Mus. Nos. R13709, R13712, R13726–7, R13729–35, R13740–1.

The series of this species was sent, amongst other animals, to the National Museum by Mr. George Aiston, of Mulka. In recognition of his interest and work, it has been named after him.

Distribution.

The map (Plate VI) showing distribution is self-explanatory and needs little comment. Only specimens at present being dealt with have been recorded on the map, and only such of those with which a specified habitat has been preserved. Generalized localities such as West Australia, Central Australia, etc., have been ignored.

Notomys gouldi appears to be confined to the south-west corner of West Australia, in country having a rainfall of from 20 to 40 inches annually. A number of specimens labelled "West Australia" were collected by Maxwell (1871), who is reputed to have lived near Perth within that area. This needs verification.

N. mitchelli and its subspecies are on the fringe of the desert country with an average rainfall of 10 inches or less. It is probable that *N. m. alutacea* extends for some distance inland from its only specified locality, Ooldea, a number of specimens being labelled "Central Australia."

N. alexis, N. cervinus, Podanomalus longicaudatus, and *P. aistoni* are in true Central Australian desert conditions, the animals being taken almost exclusively in sandy localities.

Key to the species of Jerboa Mice.

The classification of certain species is in doubt, and the key has therefore been divided into two parts, the first dealing with species examined by me, the second with those I have not seen.

A. Gular glandular area clothed with solid hair.
Incisor index less than 60° .. .. NOTOMYS

B. No gular glandular area ; throat hair normal.
Raised gland between forelegs in male only.
Incisor index more than 60° .. .. PODANOMALUS

A.1. Size large. Fur short. Pes to 40 mm.
a.1. Colour greyish brown. Pes slender .. .. .. *N. gouldi*

A.2. Size medium. Fur long. Pes to 38 mm.
a.2. Sides of body strongly ochraceous.
Pes stout .. .. *N. mitchelli*

aa.2. Fur very long and thick. Colour greyish, not ochraceous on sides of body .. .. *N. mitchelli macropus*

aaa.2. Colour reddish (leather colour).
Tail and ears russet, not brown .. .. *N. mitchelli alutacea*

A.3. Size medium. Fur long. Pes to 36 mm.
a.3. Colour pale. Ventral fur pure white to base .. *N. cervinus*

A.4. Size small. Pes to 35 mm. Fur short.
a.4. Colour almost uniform warm brown.
Ventral fur basally grey on abdominal region only .. *N. alexis*

B.1. Size large. Pes to 44 mm.
b.1. Colour brown .. .. *P. longicaudatus*

B.2. Size medium. Pes to 35 mm.
b.2. Colour greyish. Fur short .. .. *P. aistoni*

I have not seen the following species. The remarks are quoted from the author's descriptions.

1. Similar to *gouldi*, but "readily distinguishable by its large and open palatal foramina" .. .. *N. macrotis*
2. Ventral fur white to base. Incisive index 70° .. .. *N. aquilo*
3. "Readily recognised by its long tail and other resemblances to *longicaudatus* combined with its markedly smaller size." .. *N. sturti*
4. "Readily distinguishable from all species of which the skull is known by its robust build and heavy incisors" .. .. *N. mordax*

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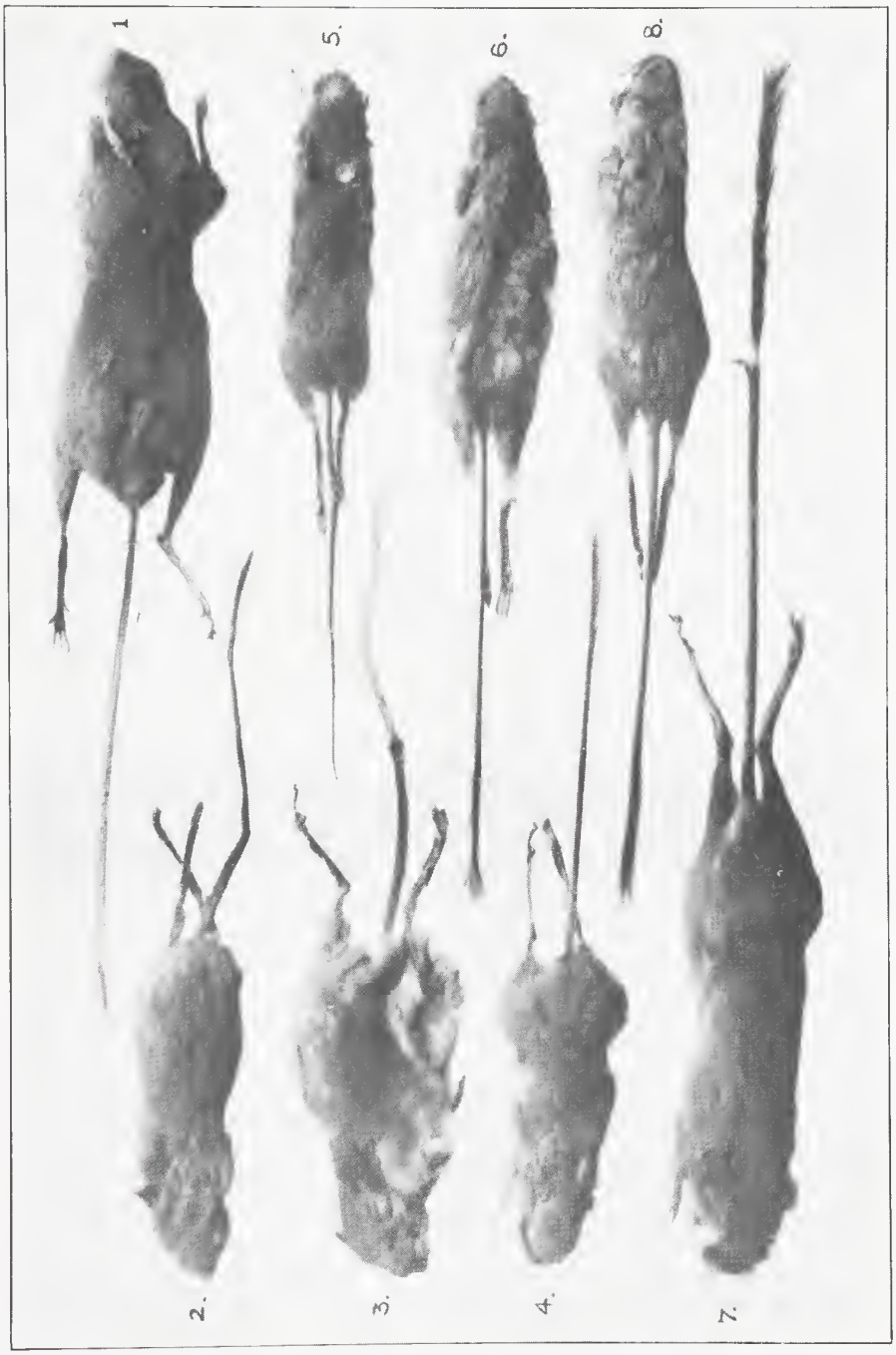
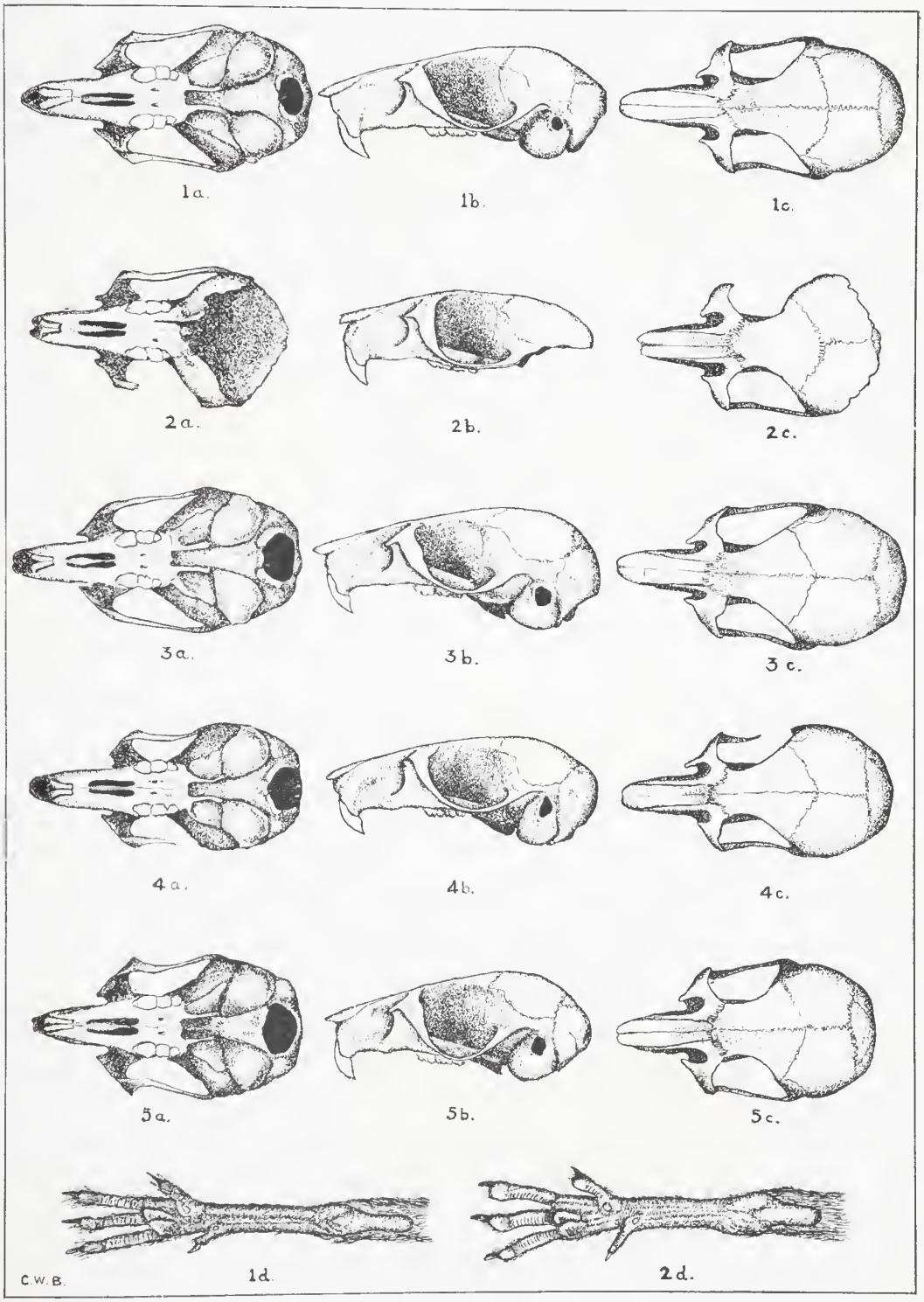
2. Edgar R. Waite. Observations on Muridae from Central Australia. Proc. Roy. Soc. Vict., Vol. X (n.s.), Pt. 2, 1898, p. 117.

3. Edgar R. Waite. The generic name Thylacomys. Ann. and Mag. Nat. Hist., Vol. V, Seventh Series, No. 28, Feb. 1900, p. 222.

4. Oldfield Thomas. On the generic arrangement of the Australian Rats hitherto referred to Conilurus, with remarks on the structure of their Molar Cusps. Ann. and Mag. Nat. Hist., Vol. XVII, Seventh Series, No. 97, Jan. 1906, p. 81.



Notomys and Podanomalus



Notomys and Podanomalus


DARWIN
WYNDHAM
BORROLOOLA
NORTHERN AUSTRALIA
COOKTOWN
CAIRNS
NORMANTON
BROOME
DERBY
TANAMI
CENTRAL AUSTRALIA
L. McDonald
L. Disappointment
ALICE SPRINGS
QUEENSLAND
ROCKHAMPTON
WESTERN AUSTRALIA
SOUTH AUSTRALIA
BRISBANE
GERALDTON
KALGOORLIE
L. Torrens
L. Frome
L. Cairdner
NEW SOUTH WALES
PERTH
C. Naturaliste
C. Leeuwin
ALBANY
ADELAIDE
SYDNEY
CANBERRA
Kangaroo I.
VICTORIA
MELBOURNE
C. Otway
Wilsons Promtry
King I.
Flinders I.
LAUNCESTON
TASMANIA
HOBART

5. Oldfield Thomas. Mammals from Northern Australia. Pro. Zoo. Soc. Lond., May to Dec. 1906, p. 539.

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8. F. Wood Jones. A Revision of the South Australian Jerboa Mice, with a description of a New Species. Records of the South Aust. Museum, Vol. III, No. 1, June 1925, p. 1.

9. F. Wood Jones. The Mammals of South Australia, Pt. III, p. 342, Adelaide ; Govt. Printer 1925.

Plate V

Fig. 1. *Notomys gouldi* (Gould).

Fig. 2. *N. mitchelli* (Ogilby).

Fig. 3. *N. mitchelli macropus* Thomas.

Fig. 4. *N. mitchelli alutacea*, sub sp. nov.

Fig. 5. *N. alexis* Thomas.

Fig. 6. *N. cervinus* (Gould).

Fig. 7. *Podanomalus longicaudatus* (Gould).

Fig. 8. *P. aistoni*, sp. nov.

Plate VI

Skulls. *a*, ventral view. *b*, lateral view. *c*, dorsal view. *d*, left pes.

Fig. 1. *Notomys gouldi* (Gould).

Fig. 2. *N. mitchelli* (Ogilby).

Fig. 3. *N. mitchelli alutacea*, sub sp. nov.

Fig. 4. *N. alexis* Thomas.

Fig. 5. *Podanomalus aistoni* sp. nov.

Plate VII

Map showing distribution.

1. *Notomys gouldi*. 2. *N. mitchelli*. 3. *N. mitchelli macropus*. 4. *N. mitchelli alutacea*. 5. *N. alexis*. 6. *N. cervinus*. 7. *Podanomalus longicaudatus*. 8. *P. aistoni*.

Body Measurements.

GENUS. SPECIES.	Sex.	Reg. No.	Head & Body.	Tail.	Hind Foot.	Ear.
			mm.	mm.	mm.	mm.
NOTOMYS.						
gouldi	♀	R1105	118	147	37·5	22·5
,,	♂	R1106	124	158	38	22·5
,,	♀	R1766	136	150	37·5	23·5
macrotis		—	118	—	40·5	26
mitchelli	♀	R2186	112	148	36	23·5†
,,		R1768	107	133	34·5	23·5†
* ,,	♀	M1660	107	151	36·5	25§
* ,,	♂	M1659	108	151	37	24§
,, *macropus*	♀	R5938	112	145	37	24
,, *alutacea*	♀	R13832	98	145	37	23
,, ,,	♀	R13834	102	144	37	23
,, ,,	♂	R13833	96	142	38	24·5
alexis	♀	R13836	97	139	32·5	18·5
,,	♀	R13837	92	123	31	19·5
,,	♂	R13838	94	105	32	20·5
aquilo		—	108	—	35	16
cervinus	♀	R13739	103	147	35·5	23
,,	♀	R12416	98	130	33	23
,,	♂	R13742	90	144	35	24
sturti		—	132	200	45	
mordax		—	—	—	—	—
PODANOMALUS.						
longicaudatus	♀	R13917	144	199	42	26
,,	♀	R13216	134		42	28
,,	♂	R13211	123	169	43	24
aistoni	♀	R13727	103	158	34	23
,,	♀	R13741	105	138	34·5	24
,,	♂	R13711	96	144	35	25

*Specimens from Ooldea ; loaned by West Aust. Museum, Perth.
†Cabinet skin.
§Spirit specimen.

Skull Measurements.

GENUS	SPECIES	Reg. No.	Greatest length	Basal length	Greatest breadth	Nasals length	Nasals breadth	Interorb. breadth	Palate length	Breadth outside M2	Breadth inside M2	Palatal foramina	Dia-stema	Length upper M series	Incisor index
			mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
NOTOMYS															
	gouldi	R13831	?33	?28	16	12·5	3	5	17	7	4	7 x 2	8	5·3	58°
	,,	R1766	?30	?25	15·5	11·5	3	5	16·5	7	3·8	6·3 x 2	7·5	5·3	—
	macrotis	—	—	—	—	12·5	—	6·1	14	—	—	6·5 x 2·6	—	5·5	—
	mitchelli	R1767	—	—	—	10·5	3	5	?14	6·3	3·3	5 x 1·8	7·5	5·2	56°
	,,	R13835	—	—	—	11·5	3·5	5	14	6·3	3·3	5·5 x 2	7·5	5	58°
	* ,,	M1555	31	26	16	11	3	5	14	6·3	3·5	5·5 x 1·8	7	5	56°
	,, *macropus*	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	,, *alutacea*	R13832	32·5	25·5	16	12	3	5·3	14	6·5	3·5	5·3 x 1·8	7	5	54°
	,, ,,	R13834	32·5	26·5	16	12·3	3	5	14·5	6·3	4	6 x 2	8	5	58°
	alexis	R13836	30	25·5	15	10	3·3	5·3	15	6·3	3	4·5 x 1·5	6·5	5	55°
	,,	R13837	28·5	25	15	11	3	5	14	6·3	3	4·8 x 1·8	6·8	5	—
	aquilo	—	—	—	—	11·2	—	5·2	13·2	—	—	5·8	—	5	—
	cervinus	R13839	31·5	27	15·5	11·5	3	5	16	6·8	3·5	5 x 1·8	8	5	58°
	,,	R13742	31	26	15·5	10	3	5	15·8	6·5	3·3	5 x 1·8	7·8	5	57°
	,,	R12416	29	24	15·3	10	3	5	14·3	6	3·2	4·5 x 2	7	5	53°
	sturti	—	—	—	—	13·8	—	6·5	16·3	—	—	8 x 2·3	—	5·8	—
	mordax	—	33·5	30	—	12·6	—	5·9	15	—	—	6·8 x 2·1	—	6·3	—
PODANOMALUS															
	longicaudatus	R13197	39	33	21	15	4·5	6·3	20·5	8·8	4·2	7·5 x 2·5	9·5	7·3	65°
	,, (*young*)	R13187	32	—	18	11	3·8	6	15·5	7·8	3·2	6·2 x 2·3	9	6·5	61°
	aistoni	R13727	28·5	24·8	15·8	10·3	3	6	14·3	6·8	3·8	5·5 x 2	7·5	5	65°
	,,	R13741	28·5	24·5	16	10	3	7	14·5	7	4	5·5 x 2	7·5	5	67°

*Ooldea specimen ; lent by West. Aust. Museum.

Notes.—*N. macrotis* :—"Upper length from back of parietals 30 mm." (Thomas).
N. aquilo :—"Back of parietals to front of nasals 26.3 mm." (Thomas).
N. sturti :—"Back of frontals to tip of nasals 25.6 mm." (Thomas).

GLANDULAR AREAS OF SOME AUSTRALIAN JERBOA MICE, AND REMARKS ON *NYCTINOMUS* AND *MYRMECOBIUS*.

By Geoffrey Bourne, Hackett Research Student.

Plate VIII.

NOTOMYS.

The genus *Notomys* as defined by C. W. Brazenor in this Memoir is distinguished from the other genus of Australian Jerboa Mice (*Podanomalus*) by a glandular area on the ventral surface of the neck.

A gular pouch also occurs in certain Australian bats of the genera *Taphozous* and *Nyctinomus*.

The gular glandular area of *Notomys cervinus* (Gould) is bounded by a raised thickened margin and is sunk below the surface of the surrounding integument. In one female it measured 7 mm. by 6 mm.; in this specimen the area of reflected skin does not extend very far forward and is small compared with the whole glandular area.

Vertical sections through the gular region of a female specimen with a definite fold of skin were examined. Some distance away from the pouch, both dermis and epidermis are comparatively thick and hair follicles with attached sebaceous glands occur. Closer to the pouch, the integument is rather hypertrophied and much folded. Still closer, small lymph glands and isolated areas of fatty tissue make their appearance ; and closer again, a number of much larger areas of lymphoid tissue are scattered through the dermis. (Pl. VIII, fig. 1).

In sections through the gular pouch the integument and the reflected flap of skin are definitely hypertrophied (Pl. VIII, fig. 2), and sebaceous glands associated with hairs are also enlarged.

Notomys mitchelli has a gular glandular area but no reflected flap of skin. Sections through this area reveal structures similar to those in *cervinus ;* integumental hypertrophy associated with enlarged and elongated hair follicles and enlarged attached sebaceous glands.

Brazenor has noted both in *N. cervinus* and in *N. mitchelli* that the hair of gular glandular areas is specialised.

In *Notomys mitchelli* the hairs towards the periphery of the area are medullated and the centre of some hairs within the

area contain elongated air-spaces. In some the air-space is confined to the portion of the hair enclosed by the follicle, and in others to the free portion of the hair.

In regard to function of the gular pouch, Waite (2) suggests that it is used for storing food. Oldfield Thomas (4) considers this extremely unlikely and that the gland is probably of a sexually attractive nature. Wood Jones (1) says that the pouch is probably glandular and that observations on captive specimens have failed to provide any clue as to its true function.

In all gular glandular areas the hairs are definitely oriented. When the area of reflected skin is small, the hairs are arranged centripetally and their free ends project towards the centre; these hairs also tend to point ventrally and form an inverted cone when the animal rests on its hind legs. When the reflected skin is larger, the tips of the hairs are directed towards a point anteriorly.

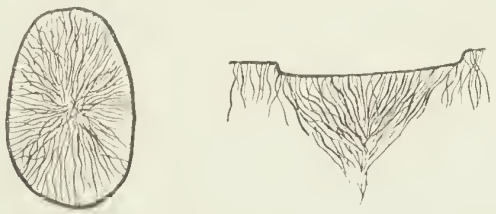

Fig 1. Arrangement of hair on gular pouch of *Notomys*: ventral and lateral views. Diagrammatic.

This arrangement of hairs suggests a definite function. Their converging tips would enable sebaceous material from the base of the hairs to run together and form a droplet. The animal may use such droplets for its toilet.

PODANOMALUS.

Podanomalus has no external indication of a gular pouch; the epidermis in the gular region is not hypertrophied and the dermis presents no unusual features. Numerous fatty and lymphoid areas are in some cases suggestive of degenerate glands. (Pl. VIII, fig. 3.)

The pre-sternal glandular area varies in size and shape, and except for a few fine, short hairs, it is almost entirely bare; it has a granulated appearance. It is lower than the surface of the surrounding integument and is bounded by a thickened rim. In one specimen it measured 6 mm. by 25 mm. Microscopically the area appears to consist almost entirely of

sudoriparous follicles somewhat similar to those described by Beddard in *Myrmecobius* (3).

Modified sudoriparous and sebaceous glands are difficult to distinguish. In this paper glands associated with hair follicles are called sebaceous glands, and those not associated with follicles, sudoriparous.

NYCTINOMUS.

The microscopic details of the gular pouch of the bat *Nyctinomus australis* were examined and were found to correspond generally with those described above in *Notomys*.

MYRMECOBIUS.

The Marsupial Anteater, *Myrmecobius*, has a pre-sternal gland which has been described by F. E. Beddard (3) from an adult female preserved in spirit. He found the following glandular structures: sweat (sudoriparous) glands; sebaceous glands; sudoriparous follicles; and a large compound tubular gland.

The present author has examined six spirit specimens of *Myrmecobius fasciatus* in the West Australian Museum through the courtesy of the curator, Mr. L. Glauert; all were females. The pre-sternal glandular area is not well marked nor is it completely bare in any of them, being covered, though thinly, with fine silky hairs. As Beddard notes there is a lens-shaped thickening of the integument in this region, but the external orifices he describes are difficult to see. Associated with the fine hairs are sebaceous glands. Sudoriparous glands are also present, but sudoriparous follicles are neither common nor typical; when present they are somewhat attenuated and bent in various directions. Some sections show sudoriparous glands opening into follicles. (Pl. VIII, fig. 4.)

No trace could be found of the compound tubular gland described by Beddard. In fact, his figures and its position beneath the dermis suggest a salivary gland.

To Mr. Brazenor of the National Museum and to Mr. Glauert of the West Australian Museum I am indebted for the material on which this paper is based.

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2. Waite, E. R. Observations on Muridae from Central Australia. Proc. Roy. Soc. Vict., Vol. X (N.S.), Pt. 2, 1898.

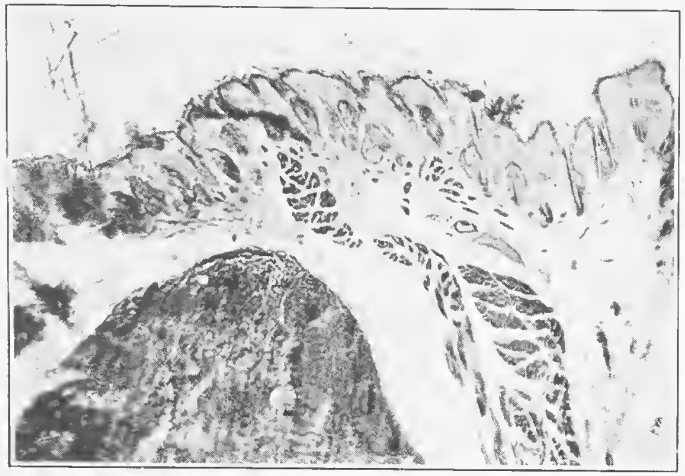

Fig. 1—Notomys

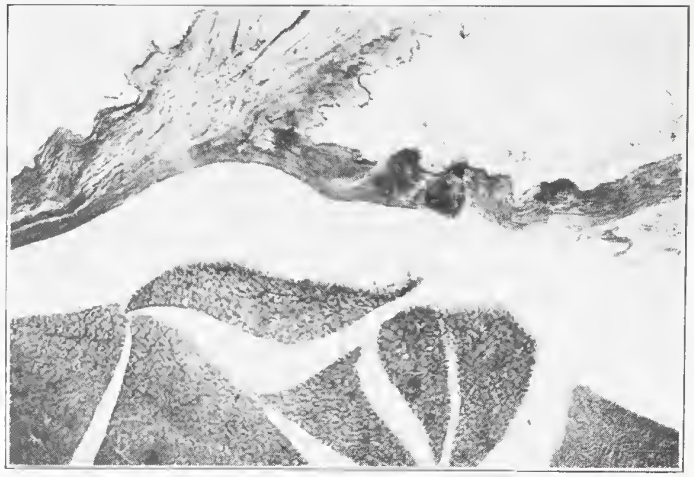

Fig. 2—Notomys.

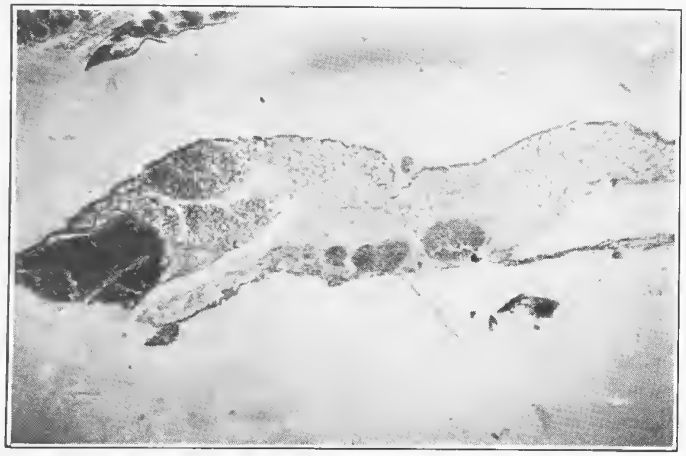

Fig. 3—Podanomalus

Fig. 4—Myrmecobius

Sections of Glandular Areas

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Plate VIII.

Fig. 1. *Notomys cervinus* (Gould). Vertical section just posterior to the gular glandular area, showing a large lymph gland underlying the dermis. × 120.

Fig. 2. *Notomys cervinus* (Gould). Vertical section through the gular glandular area ; the underlying glands are salivary glands. × 90.

Fig. 3. *Podanomalus aistoni* Brazenor. Fatty and lymphoid tissue in gular area ; vertical section. × 120.

Fig. 4. *Myrmecobius fasciatus* Waterhouse. Vertical section through presternal gland ; sudoriparous glands opening into base of sudoriparous follicle. × 90.

AN UNCOMMON TYPE OF STONE IMPLEMENT FROM AUSTRALIA AND NEW GUINEA.

By D. A. Casey, Hon. Ethnologist.

Plates IX–XI.

The stone implements, described in detail below, are of an uncommon type. Only ten examples are known to the writer; seven of these come from widely separated localities in Queensland, New South Wales, Victoria and South Australia, and three, which are smaller but similar in form, from New Guinea. Several of these implements have already been described or illustrated by various authors, but being isolated examples they have not been recognised as belonging to a definite and widespread type.

The Australian Implements.

Figs. 1–7, Plates IX, X, XI.

The implements vary in size and in details of shape but all have the same general characteristic form. They somewhat resemble bicycle saddles in plan, and several also in size. At the larger end the upper and lower surfaces converge to form a wide curved edge, and at the other there is a narrow projection, roughly circular in section and usually tapered. Where the original surface has been preserved all except one, No. 5, show signs of having been dressed to shape by hammering; some also appear to have been ground. The materials used (basalt, schist, indurated sandstone and limestone) vary greatly in composition and hardness, and some are quite unsuited to retain a cutting edge.

The purpose for which these implements were made is unknown. At first sight the curved edge suggests that they are axe-heads, but they are much too large and unwieldy to have been used for this purpose. Moreover, in most cases the edge is very thick and quite blunt and would have been useless for cutting. Possibly they were ceremonial objects.

Considering their wide distribution and the fact that they are clearly a specialised and not an elementary form, it is somewhat remarkable that only seven examples have been noted amongst the many thousands of Australian stone implements in

museums. It is unlikely that these seven are merely strays introduced from some unknown outside source. They are sufficiently varied in size and material to make this improbable, and moreover the material in each case is such as might well have come from the area in which the implement was found. The most probable explanation of their distribution is that they are an early type which has been superseded or discarded. That at least four of them are of considerable age is indicated by the fact that they are heavily patinated. It is, perhaps, significant also that in both cases where the details are known the implements were found not on the surface but below ground level.

If they are indeed an early type, these implements constitute one of the very few fragments so far discovered of material evidence of the early cultural history of the Australian aboriginal.

1. *From Myponga, South Australia, 38 m. S. of Adelaide.* Fig. 1, Plates IX and X.

Fine grained massive schist or micaceous sandstone, considerably patinated all over. The marks of hammer-dressing are visible over most of the surface. In section the edge is very obtuse and, except at one extremity, is only roughly formed. Found by Mr. Alex. Cameron, about 1892, when digging a post hole.

Weight, 14 lbs. Length, 14.4 inches.

South Australian Museum, No. A. 4552.

2. *From Emu Lake, Kinchega Station, N.S.W. 6 m. S.W. of Menindee.* Fig 2, Plates IX and X.

Moderately fine grained, greenish grey, indurated siliceous sandstone or quartzite. The surface is slightly worn but there is no perceptible alteration by weathering. The whole surface retains marks of hammer-dressing and has not been ground. The implement is well shaped and symmetrical except that one face is slightly concave and the other convex. There is a slight but distinct constriction round the implement where the narrow projection merges into the expanded portion.

Weight, 4 lb. 12 oz. Length, 9.6 inches.

South Australian Museum, No. A4551.

Numbers 1 and 2 are described here through the courtesy of the Director of the South Australian Museum, who has been

good enough to make them available to this Museum for examination. These two implements have been illustrated in outline by Edge Partington, Pacific Islands Album III, 1898, p.142. An inferior illustration of No. 2 appears in Eylmann, Die Eingeborenen der Kolonie Sudaustralien, 1908, Pl. XXII, fig. 10.

3. *From Deighton Station, Lake Victoria, Gippsland, Vic.* Fig. 3, Plates IX and X.

Fine grained compact basalt. The surface is oxidised to a depth of about .06 inch, and is much altered and smoothed by weathering. No traces of hammer-dressing remain. The edge is very rounded and blunt except at one extremity; the opposite extremity has been broken.

Weight, 12 lb. Length, 13.25 inches.

National Museum, No. 24668.

4. *From Yarraman Creek, near Cooyar, Darling Downs, Queensland, 40 m. N. of Toowoomba.* Fig. 4, Plate IX.

The following description is based on a note in the Proceedings of the Royal Society of Queensland, Vol. XXIX, 1917, p. xvi, and on a plaster cast of the implement now in the National Museum.

Medium grained basalt, considerably weathered. Under a thin brown ironstained coating there is a rather thicker layer of weathered felspatic material resting on the darker and fresher rock. The implement is well-shaped and symmetrical. The edge is reasonably good but not sharp.

Said to have been found below the surface of the ground.

Length, 9 inches.

Queensland Museum, No. Q.E. 1228.

5. *From Kallara Holding, Darling River, N.S.W., 40 m. S.W. of Louth.* Fig. 5, Plate IX.

This implement has been described and illustrated in Records of the Australian Museum XVI 1927–28, p. 248, Pl. XXVII, fig. 2. The director of the Australian Museum has been good enough to send the implement to Melbourne for examination.

Ferruginous quartzite, slightly patinated. The implement is roughly chipped all over except for a small area on one face

where the natural surface remains. There are no signs of hammer dressing or grinding. Possibly it is in an unfinished state.

Weight, 7 lb. 12 oz. Length, 12.7 inches.

Australian Museum, No. E11947.

6. *Locality unknown.* Almost certainly from Queensland and perhaps from Olsen's Caves, Rockhampton District. Fig. 6, Plate IX.

The drawing and description of this implement have been supplied by Mr. H. A. Longman, Director, and Professor H. C. Richards, Hon. Mineralogist of the Queensland Museum.

Basic volcanic rock, probably a normal fine-grained olivine basalt very similar in type to much of the late Tertiary basic volcanic material of Eastern Australia. The specimen is not patinated and appears relatively recent in comparison with No. 4. The surface is ground.

Weight, 3 lb. 4 oz. Length, 7.9 inches.

Queensland Museum, No. Q.E. 1234.

7. *From near Brisbane.* Fig. 7, Plates IX and XI.

The Museum is indebted to Mr. H. J. Braunholtz of the Department of Ceramics and Ethnology of the British Museum for the following description of this implement, and also for the photograph, Plate XI, from which the figure on Plate IX has been made.

Apparently limestone, fairly hard, grey on the surface and white where chipped. Roughly pitted all over, presumably by hammer-dressing, and weathered. One side is slightly convex and the other practically flat, probably having been ground. The edge is not sharp but appears to have been partly ground down also. Found on high land near Brisbane and given to the British Museum by B. H. Purcell, Esq., in 1897.

Length, 10.8 inches. Maximum thickness, 3 inches.

British Museum, No. 97–652.

The New Guinea Implements.

Figs. 8–10, Plate IX ; figs. 9, 10, Plate XI.

Being of a more suitable size, these were presumably axes. The chipped obsidian implement No. 8 is unique, and the other

two are the only examples of this type of implement which are known from New Guinea. According to Mr. E. W. P. Chinnery, Government Anthropologist, T.N.G., such implements are not made or used by the present natives. All three came from below ground level, and are almost certainly prehistoric.*

Their similarity of outline strongly suggests relationship with the Australian implements, but with so few examples and with our present lack of knowledge of the archaeology of the two countries, the point cannot be stressed. It is significant, however, that similar implements appear to be an early type both in Australia and in New Guinea.

8. *From the Yodda Valley, Papua.* Fig. 8, Plate IX.

This implement was first described by C. A. W. Monckton, Resident Magistrate, British New Guinea Annual Report 1903–4, Appendix D., p. 31. It has also been illustrated and described by C. G. Seligman, and T. A. Joyce, Anthropological Essays presented to E. B. Tylor, 1907, p. 327.

Made from a single large flake of obsidian. The sides and butt are regularly and symmetrically shaped by secondary flaking, from both front and back. (Part of the butt is at present obscured by a modern hafting.) The degree of skill shown in the making of this implement is without parallel amongst chipped implements from New Guinea or the adjacent islands. The technique of working from both sides is not otherwise known from this area. As an axe the implement is unique also, in that the untrimmed edge of the flake has been utilized as the cutting edge.

Found below the surface of the ground.

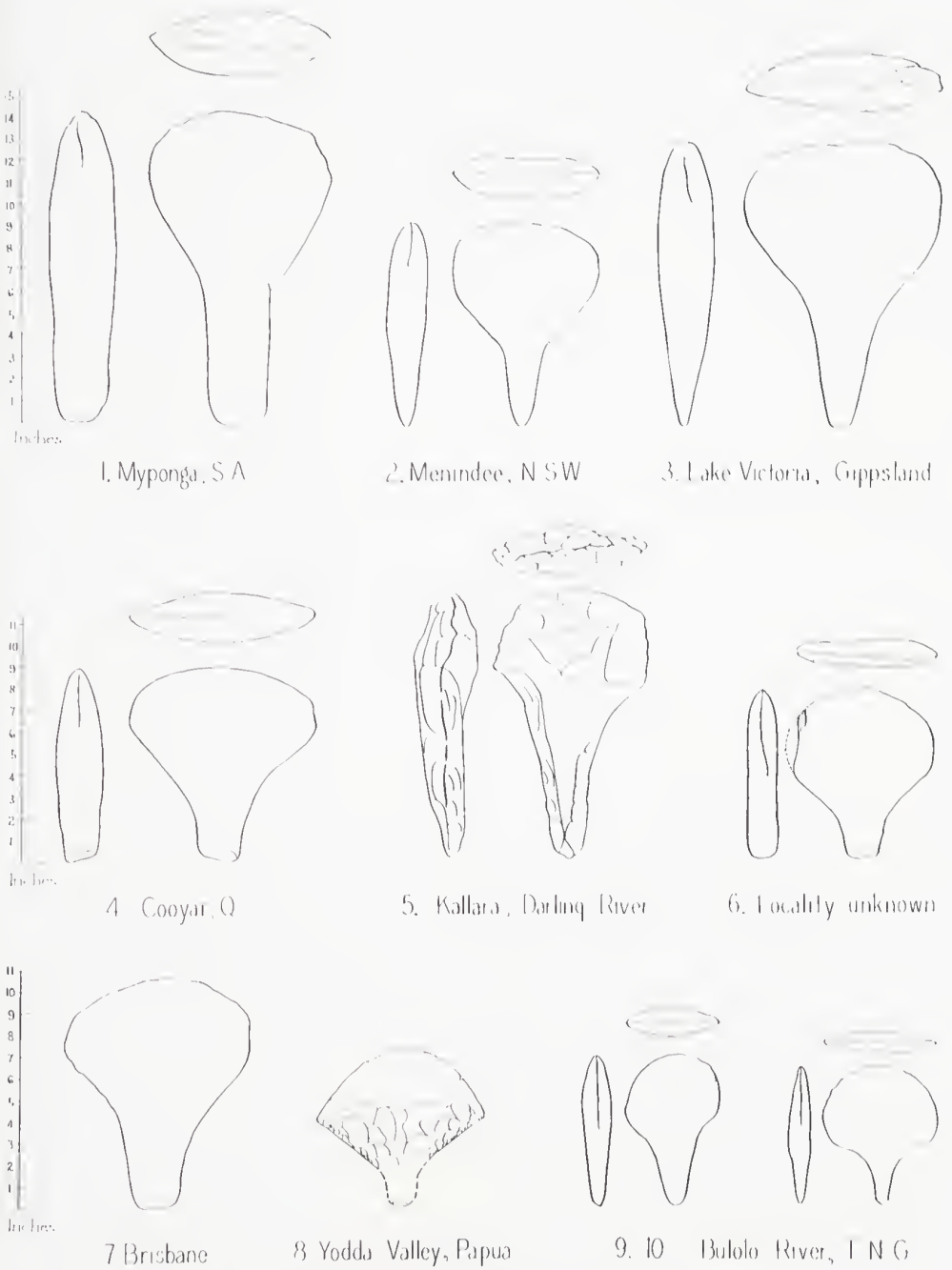
Length, 7.2 inches. Maximum thickness, about 2 inches.

In the collection of the London Missionary Society, Samarai, Papua.

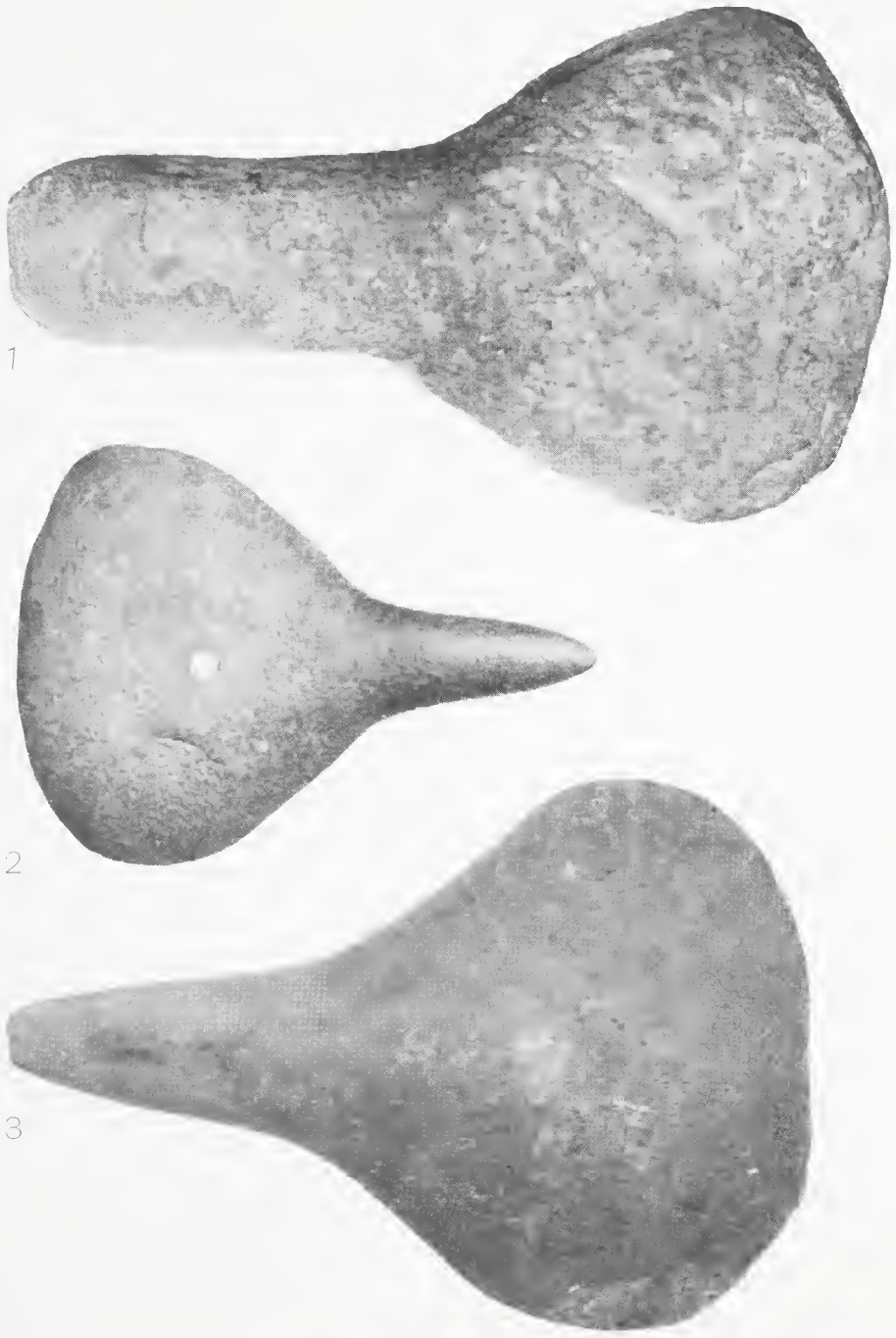
9. *From left bank of Nami Creek at its junction with the Bulolo River, Territory of New Guinea.* Fig. 9, Plates IX and XI.

Hard, fine-grained micaceous schist. Weathered or worn so that the harder portions of the rock protrude as ridges. Traces of what is apparently hammer-dressing are visible but most of the original surface has disappeared.

*For evidence of a prehistoric culture in New Guinea, see : E.W.P. Chinnery, Journal of the Royal Anthropological Institute, XLIX, 1919, p. 271 ; also C. G. Seligman and T. A. Joyce, Anthropological Essays Presented to E. B. Tylor, 1907, p. 325.



Stone Implements from Australia and New Guinea



Stone Implements from Australia

Stone Implements from Australia and New Guinea

Found in a sluice box in which auriferous wash was being treated. The wash came from a terrace gravel deposit which extended from 12 ft. to 45 ft. below the surface. Twelve feet of overburden had been removed. It is thus probable that the implement came from the gravel, at some depth between 12 to 45 feet, but the possibility that it may have been accidentally included from the overburden cannot be ignored.

Length, 6.75 inches.

National Museum, No. 40372.

10. *From right bank of Nami Creek at its junction with Koranga Creek, Bulolo Goldfield, Morobe District, Territory of New Guinea (about ½ mile above the position of No. 9).* Fig. 10, Plates IX and XI.

Very fine grained dark green compact homogeneous rock, with the remains of an interbedded vein of calcite on one side. Abraded but not patinated. It is doubtful whether marks on the surface are those of hammer-dressing or not.

Found in a sluice box under conditions similar to No. 9.

Length, 6.25 inches.

National Museum, No. 40373.

A REVISION OF THE GENUS MALURUS

By George Mack, National Museum.

The genus *Malurus* is confined to Australia, Tasmania, and some small adjacent islands. Probably in no other group is distribution so complete, at least one species being present in every part of the continent. The bright and beautifully plumaged males attract attention equally in the temperate south, the dry interior, and the tropical north.

This paper is based chiefly upon the excellent series in the H. L. White collection in the National Museum, augmented by the museum general collection. For substantial additional representatives of four species I am indebted to the Australian Museum, Sydney, and the South Australian Museum, Adelaide. To the Directors and officers responsible for the bird section of these two museums I owe my warmest thanks. The late Dr. William Macgillivray, of Broken Hill, kindly forwarded all his specimens of two northern species.

A typical male and female of each species are described, standard colour terms, from Ridgway's *Color Standards and Nomenclature*, being used ; all measurements are in millimetres. Maps are included on which is outlined the range of the various forms.

Genus MALURUS Vieillot.

Malurus Vieillot, Analyse nouv. Ornith., p. 44, 1816. Type, *Motacilla cyanea* Latham.

Leggeornis Mathews, Aust. Avian Rec., 1, p. 113, 1912. Type, *Malurus lamberti* Vigors and Horsfield.

Of the thirteen species included here, four differ from the genotype in lacking prominent, erectile ear-coverts, and in the widely different colour-pattern of their plumage ; three of these four species are similar in size and are the smallest of the genus, while the fourth is the largest. These differences are here recognised by accepting three subgenera (*Malurus, Hallornis*, and *Rosina*) containing nine, three and one species respectively. Structure of bill and feet, and the wing formula are similar in all species. Rictal bristles are five in number and vary in length roughly in proportion to the size of the bird. Some cabinet specimens have less than the proper number of bristles since these are easily lost in preparing skins. This fact appears to have misled Mathews, for in five of the six genera accepted

by him a different number is given. A feature of the genus that does not seem to have been previously noted is that the two outer tail feathers are minute, being little longer than the under tail-coverts.

Key to the Species.

Ear-coverts prominent, erectile .. .. Subgenus MALURUS
- Scapulars not chestnut
  - Abdomen mostly white .. .. *cyaneus*
  - Abdomen mostly blue
    - Lower back black
      - Head and mantle darker (bradley's blue) .. *melanotus*
      - Head and mantle lighter (calamine blue) .. *callainus*
    - Lower back blue .. .. *splendens*
- Scapulars chestnut
  - Throat black
    - Lower under surface mostly white, flanks tinged buff
      - Ear-coverts paler than head .. .. *lamberti*
      - Ear-coverts similar in colour to head .. .. .. *amabilis*
    - Lower under surface mostly white, flanks tinged bluish lavender .. .. *dulcis*
  - Throat blue-violet
    - Head, ear-coverts and upper back similar in colour, lighter.. *elegans*
    - Head, ear-coverts and upper back differing in colour, darker .. .. *pulcherrimus*

Ear-coverts not prominent, not erectile
- Size small .. .. Subgenus HALLORNIS
  - Colour of plumage mostly blue
    - Scapulars and inner secondaries white .. .. *leuconotus*
  - Colour of plumage mostly black
    - Scapulars and inner secondaries white .. .. *leucopterus*
    - Scapulars and back red .. .. *melanocephalus*
- Size large .. .. Subgenus ROSINA
  - Centre of crown black surrounded with purple .. *coronatus*

Subgenus MALURUS Vieillot.

Malurus (*Malurus*) *cyaneus* (Latham).

This well-known species is the genotype, and is the only species found in south-east Australia. Four distinctive races have long been considered worthy of separation. Individual variation in colouration appears to account for more recently described subspecies.

Malurus (*M.*) *cyaneus cyaneus* (Latham).

Motacilla cyanea Latham, Gen. Syn. Birds, 2, p. 501, 1783; Adventure Bay, South Tasmania.

Motacilla superba Shaw, Naturalists' Miscellany, 1, p. 10, 1789; S. Tasmania.

Malurus longicaudus (not Temminck, 1820) Gould, Syn., pt. 4, App., p. 4, 1838 ; S. Tasmania.

Malurus gouldi Sharpe, Cat. Birds Brit. Mus., 4, p. 287, 1879 ; new name for above.

Malurus cyaneus fletcherae Mathews, Aust. Avian Rec., 1, p. 93, 1912 ; Ringarooma, North Tasmania.

Range.—Tasmania.

Specimens examined.—28 from the following localities—Hobart, Railton, Bridport, Browns River, Scottsdale, Launceston, Devonport and Springfield.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
22 males ..	53–55·5 (54)	61–72 (65·4)	9–10 (9·9)	22–25 (23·2)
6 females ..	50–55 (53)	63–73 (67)	9–10 (9·8)	23–24 (23·3)

Male.—Forehead to nape, cheeks, ear-coverts and mantle salvia blue ; lores, supraloral stripe, which joins a broad band on back and sides of neck, scapulars, lower back and upper tail-coverts black ; wings fuscous, outer margins of quills pale olive-grey, all upper coverts washed and marked with blue which varies greatly in shade ; tail urania blue, some feathers lighter on margin of outer web and tipped white ; chin, throat and breast dusky blue-violet (2) followed by a narrow band of black ; remainder of under surface white tinged buff and becoming drab on flanks and under tail coverts ; some feathers adjoining the black band on breast tipped pale blue ; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills whitish. "Bill black ; eyes and feet brown."

Female.—Upper surface, including upper wing-coverts, mummy brown ; wing-quills fuscous, lighter on outer margins, from mummy brown on innermost secondaries to greyish on primaries ; tail olive-brown faintly suffused with blue ; lores and feathers around eye chestnut ; under surface white, tinged buff, and becoming drab on abdomen, flanks and under tail coverts. "Bill chestnut ; eyes brown ; feet light brown."

Individual variation in colour of head and mantle of the male is marked. No consistent difference between specimens from the north and south of the island is apparent.

Malurus (*M.*) *cyaneus elizabethae* Campbell.

Malurus elizabethae A. J. Campbell, Ibis, 1901, p. 10 ; King Island, Bass Strait.

Malurus cyaneus samueli Mathews, Aust. Avian Rec., 1, p. 93, 1912 ; Flinders Island, Bass Strait.

Range.—King Island and Flinders Island, Bass Strait.

Specimens examined.—18 from both islands.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
12 males ..	54–56 (54·8)	59–69 (67·4)	10	23–25 (23·8)
2 females ..	53–54	65–60	10	24

Subspecific characters.—Essentially similar in size to typical *cyaneus* but differs in having wings near to fuscous-black, secondaries broadly margined with deep blue, lighter and less pronounced on primaries, and upper coverts much suffused with blue and dusky-blue violet (2).

This form is easily recognised by the amount of blue in the wing. Variation in the colour of head and mantle is even greater than in typical *cyaneus*, some specimens, including the type, having these parts rich deep blue, near to bradley's blue. Examples from Flinders Island, while having slightly less blue in the wing, equal in all other respects those from the type locality.

Malurus (*M.*) *cyaneus australis* North.

Malurus australis North, Ibis, 1904, p. 672 ; Sydney, New South Wales.

Malurus cyaneus henriettae Mathews, Nov. Zool., 18, p. 357, 1912 ; Olinda, Victoria.

Malurus cyaneus leggei Mathews, *ib.*, p. 358, 1912 ; Port Adelaide, South Australia.

Malurus cyaneus ashbyi Mathews, *ib.*, p. 358, 1912 ; Kangaroo Island, South Australia.

Range.—From about Sydney, New South Wales, south and west to Eyre Peninsula, South Australia.

Specimens examined.—32 from the following localities—Eastwood (Sydney), New South Wales ; Rutherglen, Ararat, Alexandra, Olinda, Selby, Yarra Glen, Rosedale, Narnargoon, Mitcham, Black Rock, Melbourne, Queenscliff, Cape Otway Forest, Lorne, Victoria ; St. Kilda, South Australia ; Kangaroo Island.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
22 males ..	50–55 (52)	53–65 (59·6)	9–9·5	21–24 (22·1)
7 females ..	49–52 (50·5)	57–64 (60·2)	9	21–22 (21·5)

Subspecific characters.—Averages less in all dimensions than typical *cyaneus* and *elizabethae*, and the blue of head and mantle, although variable, is generally lighter than in these two insular forms. Differs from *cynochlamys* in its much deeper colouration.

Separation of mainland birds other than *australis* and *cynochlamys* appears to me unwarranted. Different shades of blue are apparent in specimens from the same locality.

Malurus (*M.*) *cyaneus cynochlamys* Sharpe.

Malurus cynochlamys Sharpe, Proc. Zool. Soc., 1881, p. 788 ; Moreton Bay, South Queensland.

Range.—Moreton Bay, S.E. Queensland, south to about Sydney, New South Wales on the coast, and towards the Murray River inland.

Specimens examined.—76 from the following localities—Brisbane, Dawson River, S. Queensland ; Warialda, Scone, Dungog, Maitland, Cobbora, Lithgow, Tarana, Rylstone, Tuggerah, Seaham, Upper Chichester River, Burrawa, Bathurst, New South Wales.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
58 males ..	49–54 (50·6)	50–63 (56·1)	8–9 (8·6)	20–23 (21·1)
16 females ..	48–52 (49·9)	55–63 (59·6)	8–9 (8·3)	20–22 (20·8)

Subspecific characters.—Differs from all other forms in its much paler colouration. Averages slightly less in all dimensions than *australis*. Head, ear-coverts and mantle sky blue ; upper wing-coverts and innermost secondaries more or less drab ; lower under surface more distinctly white, the drab on the flanks being much restricted or lacking. Female lighter, being olive-brown rather than mummy brown on the upper surface.

The extensive series examined shows intergradation with *australis* on and near the coast about mid-New South Wales. Inland, however, *cynochlamys* appears to range much further south. All specimens from localities west of Sydney are almost exactly intermediate between *cynochlamys* and *australis*.

Fig.1—Distribution.

1 *Malurus (Malurus) cyaneus cyaneus* ; 1a *M.(M.) c. elizabethae* ; 1b *M.(M.) c. australis* ; 1c *M.(M.) c. cynochlamys* ; 2 *Malurus (M.) melanotus* ; 3 *Malurus (M.) callainus callainus* ; 3a *M.(M.) c. whitei* ; 4 *Malurus (M.) splendens splendens* ; 4a *M.(M.) s. aridus*.

Malurus (Malurus) melanotus Gould.

Malurus melanotus Gould, Birds of Aust., 3, p. 20, 1841 ; Murray River Belts, South Australia.

Malurus melanotus victoriae Mathews, Nov. Zool., 18, p. 358, 1912 ; Carina, North-west Victoria.

Range.—South-western Queensland, south through western New South Wales to the mallee country of N.W. Victoria, and adjoining part of South Australia.

Specimens examined.—28 from the following localities—Mogil, 60 miles north of Bourke, near Bourke, Byrock, New South Wales; Kow Plains, Raak, Pine Plains, Linga, Ned's Corner, Victoria; Pungonda, Overland Corner, Bowhill, South Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
23 males ..	50–54 (51·5)	50–63 (58·2)	8–9 (8·2)	20–22 (21·3)
4 females ..	47–51 (49·2)	55–70 (60·5)	8–9 (8·2)	20

Male.—Forehead to nape, mantle and upper tail-coverts bradley's blue; cheeks and ear-coverts ethyl blue; lores, a band on back and sides of neck, which is joined by a narrower band from behind the eye and one from below the ear-coverts, black like lower back; scapulars black tipped blue; tail dusky blue, lighter towards base and some feathers tipped white; wings fuscous, upper coverts suffused with calamine blue like outer margins of primaries and secondaries; under surface bradley's blue, becoming lighter and mottled with white on lower part of abdomen and crossed on the breast by a narrow band of black which continues upwards, joining the nuchal band on sides of neck; axillaries and under wing coverts pinkish buff, inner margins of wing-quills almost white. "Bill and feet black; eyes brown."

Female.—Upper surface, including wings and upper wing-coverts, fuscous, outer margins of wing quills whitish; tail dusky green-blue, some feathers tipped white; lores and feathers around eye fawn colour; under surface whitish, tinged buff and becoming drab on flanks and under tail-coverts; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill light brown; eyes hazel; feet slate."

The field-notes and remarks given by Mathews under the heading of this species are confusing. For the most part they refer to *M. callainus* which, in my opinion, is specifically distinct from *melanotus*, and, so far as is known, the ranges of the two species do not overlap.

The series examined shows individual variation but no constant localized difference. The Mallee country of Victoria is similar and close to the typical locality, and specimens from these two districts are not separable.

Malurus (*Malurus*) *callainus* Gould.

As stated above, this species is sharply distinct from *melanotus* with which it has been confused.

Malurus (*M.*) *callainus callainus* Gould.

Malurus callainus Gould, Proc. Zool. Soc., 1867, p. 302; South Australia = Eyre Peninsula.

Malurus melanotus musgravi Mathews, Birds of Aust., 10, p. 69, 1922; Musgrave Range, Central Australia.

Range.—From Eyre Peninsula, west and north to the Macdonnell Ranges, Central Australia.

Specimens examined.—26 from the following localities—Wertigo, Donalds Plain, 18 miles N.W. of Kimba, Gawler Range, Kallioota, Kychering, 132 miles west of Tarcoola, Ooldea, Wantapella, South Australia; Finke River, Hermannsburg, James Range, Central Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
17 males ..	49–54 (52)	55–63 (59·8)	8–9 (8·8)	21–22 (21·4)
7 females ..	48–52 (50·1)	56–62 (58·4)	8–9 (8·8)	21–22 (21·2)

Male.—Forehead to nape, mantle and upper tail-coverts calamine blue; cheeks and ear-coverts pale turquoise green; lores, a band on back and sides of neck, joined by a narrower band from behind the eye and one from below the ear-coverts, black like lower back; scapulars black tipped methyl blue; wings fuscous, upper wing-coverts suffused, and primaries and secondaries margined on outer web, with calamine blue; tail dark delft blue, some feathers tipped white; chin, throat and upper breast phenyl blue followed by a narrow band of black which continues upwards and joins the black nuchal band on sides of neck; remainder of under surface light methyl blue mottled with white on lower abdomen; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill and feet black; eyes dark brown."

Female.—Upper surface including upper wing-coverts drab; wing quills slightly darker, outer margins varying from whitish on primaries to drab on innermost secondaries; tail dusky blue-green, some feathers tipped white; lores and feathers around eye vinaceous-fawn, shafts of feathers lighter; under surface whitish, tinged buff, and becoming light drab to drab on flanks and under tail-coverts; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill light brown; eyes and feet dark brown."

The deeper colour on the under surface ascribed to *musgravi* appears to be individual, but more material is desirable.

Malurus (*M.*) *callainus whitei* Campbell.

Malurus whitei Campbell, Emu, 1, pt. 2, p. 65, 1902; Interior.

Malurus melanotus germaini Mathews, Nov. Zool., 18, p. 359, 1912; Port Germein, South Australia.

Range.—So far as known, from Port Germein north to the vicinity of Port Augusta, South Australia.

Specimens examined.—6 from Port Germein and near Port Augusta.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
5 males ..	49–52 (50·4)	54–62 (57·4)	8–9 (8·2)	21

Subspecific characters.—Similar in size to typical *callainus* but differs in having much darker head, mantle and upper tail-coverts, the colour being light methyl blue, not calamine blue.

This is almost certainly the form described by Campbell; although he gave no definite locality, his remarks suggest that his material came from near Port Augusta. Restricted in range and little known, nevertheless this race appears valid. The deep colour of the head, mantle and upper tail-coverts is constant in the adult males examined.

Malurus (Malurus) splendens (Quoy and Gaimard).

Climatically the south-west part of Western Australia inhabited by this species ranges from moist to arid. West of a line from Albany (the type locality of *splendens*) to the coast north of Perth, the annual rainfall averages 30 to 40 inches and vegetation is luxuriant. Eastwards, the annual rainfall decreases to 10 inches or less. These extremes in climatic conditions are reflected in the material examined. Specimens from the dry habitat are much paler than those from the coastal area, and as they appear to be representative examples, they are here referred to a new subspecies.

Malurus (*M.*) *splendens splendens* (Quoy and Gaimard).

Saxicola splendens Quoy and Gaimard, Voy. de l'Ast., 1, p. 197, 1830; Albany, South-west Australia.

Malurus pectoralis (not Stephens, 1826) Gould, Proc. Zool. Soc., 1833, p. 106; Swan River, Western Australia.

Malurus splendens perthi Mathews, Birds of Aust., 10, p. 73, 1922; new name for above.

Range.—From about Albany west to the coast and north, probably to Geraldton, S.W. Australia.

Specimens examined.—17 from the following localities—Bannister, Kalgan River, Augusta, Vasse River, Lake Matilda, Mandurah, Beverley, Guildford, and Perth, S.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
9 males ..	50–55 (52·8)	60–69 (63·9)	9	22–24 (22·8)
5 females ..	50–53 (51·6)	63–68 (65)	8–9 (8·8)	22–24 (23)

Male.—Entire upper surface, except nuchal band, smalt blue; cheeks and ear-coverts sky blue; lores, a narrow band from behind the eyes and one from below the ear-coverts black like the nuchal band into which they merge; scapulars black, tipped blue-violet; wings fuscous, primaries and secondaries margined on outer web with light cerulean blue, upper coverts suffused with same colour and tipped blue-violet; tail dusky blue-violet (1), some feathers tipped white; chin, throat and upper breast bluish violet followed by a narrow band of black across the breast which continues upwards and joins the black nuchal band on sides of neck; remainder of under surface blue-violet, lighter and mottled with white on abdomen; axillaries and under wing-coverts

pinkish buff, inner margins of wing-quills cartridge buff. "Bill black; eyes deep brown; feet very dark brown."

Female.—Upper surface, including upper wing coverts, hair brown; wing-quills fuscous, outer margins whitish; tail deep bluish grey-green, some feathers tipped white; lores and feathers around eye fawn colour; under surface whitish, tinged drab, and becoming drab-grey on flanks and under tail-coverts; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill light brown; eyes deep brown; feet very dark brown."

Regarding the name *perthi* Mathews stated . . . "for the form from Perth, described by Gould as *M. pectoralis*, which name is preoccupied as shown above, and which differs from the one named by Quoy and Gaimard from King George Sound." He gave no single character, and no difference is apparent in available specimens from the two localities.

Malurus (M.) splendens aridus, subsp. nov.

Subspecific characters.—Markedly lighter in colouration than typical *splendens*, particularly head, ear-coverts, and mantle. Forehead mazarine blue, deepening to salvia blue on nape and mantle; ear coverts pale cerulean blue.

Type.—No. 2361, H. L. White Collection, Nat. Mus. Victoria; ♂ ad., Lake Way, Western Australia, 18.7.1909 (F. L. Whitlock).

Range.—From the Stirling Ranges north probably to the Murchison River, and east, at least to Lake Way and Kalgoorlie, Western Australia.

Specimens examined.—9 from the following localities—Lake Way, Yalgoo, Stirling Ranges and Broome Hill, Western Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
6 males ..	50–53 (52)	59–67 (62·3)	8–9 (8·8)	21·5–23 (22·5)
1 female ..	53	63	9	21

The difference in colour between this and typical *splendens* is marked, but much more material from the wide range given is desirable. A male from Yalgoo closely resembles the Lake Way specimen. Those from Broome Hill, and, to a less extent, Stirling Ranges, reflect the close promixity of these localities to the range of the typical form. The species has been recorded between Kalgoorlie and Eucla on the border of South Australia, but no specimens have yet been collected. No representative is contained in collections made at Zanthus and Naretha in that part of the State.

Malurus (M.) splendens riordani Mathews.

Malurus splendens riordani Mathews, Aust. Avian Rec., 1, p. 119, 1912; Yalgoo, Western Australia.

"Differs from *M. s. splendens* in its much deeper colour, and in having a very much slimmer bill." (Mathews)

No specimen exhibiting these characters has been seen by me. A single male from Yalgoo is markedly lighter than typical *splendens* and is here referred to *M. s. aridus*, new subspecies.

Malurus (*Malurus*) *lamberti* Vigors and Horsfield.

Ranging over the greater part of the continent and reaching the coast at least on the east and west, this is the most widely distributed wren of the genus. Four species with a similar type of plumage (*amabilis, dulcis, elegans,* and *pulcherrimus*) are confined to relatively small areas where the range of *lamberti* does not extend.

A very interesting and representative series of specimens has been examined, and four readily recognised subspecies are admitted.

Malurus (*M.*) *lamberti lamberti* Vigors and Horsfield.

Malurus lamberti Vigors and Horsfield, Trans. Linn. Soc., 15, p. 221, 1827 ; New South Wales.

Range.—South-eastern Queensland south to Sydney, New South Wales (coastal).

Specimens examined.—21 from the following localities—Macpherson Range, South Queensland ; Tweed River, Richmond River, Lionsville, Stanwell Park, Wolgan Valley, Yarra Bay, Long Bay, Roseville, and near Sydney, New South Wales.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
14 males ..	48–51 (49·5)	68–80 (73)	9–10 (9·5)	21–22 (21·7)
5 females ..	48–49 (48·4)	67–78 (73·8)	9	21

Male.—Forehead and crown calamine blue, merging into methyl blue on nape ; ear coverts and feathers around eye paler than crown ; lores, a band on back and sides of neck, lower part of back and upper tail coverts black ; upper back methyl blue like nape ; scapulars chestnut ; wing-quills fuscous, outer margins of primaries whitish, upper wing-coverts hair brown ; tail dark olive-grey, some feathers tipped white ; chin, throat and breast black, a few feathers on sides of breast tipped blue-violet ; remainder of under surface white becoming buffy brown on flanks and under tail coverts ; axillaries and under wing coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill black ; eyes dark brown ; feet brown."

Female.—Upper surface olive-brown ; wing-quills fuscous, outer margins of primaries whitish, upper wing-coverts hair brown ; tail dark olive grey, some feathers tipped white ; lores and feathers around eye chestnut ; chin and throat whitish merging into the olive brown of the upper surface on sides of neck ; remainder of under surface cream-buff becoming buffy brown on

flanks and under tail-coverts ; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill reddish brown, eyes dark brown, feet brown."

The marked difference in colouration, particularly of the head and upper back, between typical *lamberti* of the coastal fringe and *assimilis* immediately west of the coastal range is considered by some workers sufficient to warrant specific rank for both. The contrast between individuals, however, is greatly minimised in a good series of specimens and by the fact that some examples of *lamberti* from the northern part of its range provide evidence of intergradation. For the greater part of the range of both, the coastal mountains seem to form an effective barrier between them ; but from south to central-east Queensland the higher country trends westward away from the coast, is more broken, and three distinct races appear to inhabit that area. Unfortunately, no specimens are available from the coastal country between Rockhampton and South Queensland, but those from inland near the former locality are typical *mastersi* as defined below, in the south-east is *lamberti*, and between these two, though well inland, is the type locality of *dawsonianus* (=*assimilis*). Available material is not sufficient for detailed study of the relationship of the three races in that part of Queensland.

Malurus (*M.*) *lamberti assimilis* North.

Malurus assimilis North, Vic. Naturalist, 18, p. 29, 1901 ; Mossgiel, New South Wales.

Malurus lamberti dawsonianus H. L. White, Emu, 16, p. 69, 1916 ; Dawson River, South Queensland.

Range.—North-west Victoria, north-east through inland New South Wales to the Dawson River district, South Queensland.

Specimens examined.—18 from the following localities—Nhill, Bendigo, Linga, Raak, Kow Plains, North-west Victoria ; Mossgiel (type of *assimilis*), Bourke, Byrock, Warialda, New South Wales ; Dawson River, Queensland (type of *dawsonianus*).

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
12 males ..	48–52 (49·1)	65–75 (71·1)	8·5–10 (9)	20–22 (20·7)
5 females ..	47–49 (47·8)	54–77 (66·4)	8–9·5 (8·8)	20–21 (20·6)

Subspecific characters.—Differs from typical *lamberti* in the much deeper colouration of head, ear-coverts, upper back and tail, approaching nearest in this respect to *bernieri* ; forehead phenyl blue deepening to smalt blue on nape and upper back ; ear coverts and feathers around eye about light methyl blue tinged smalt blue ; tail dark bluish grey-green ; under surface from breast downwards is lighter, being white tinged deep olive-buff on flanks and under tail-coverts. The female is brownish olive rather than olive brown on upper surface.

This well marked form inhabits the better class of country between the eastern coastal watershed and the dry interior. Comparison of the type of *assimilis* with that of *dawsonianus* proves the latter name to be a synonym.

Malarus (*M.*) *lamberti mastersi* Mathews.

Malurus lamberti mastersi Mathews, Nov. Zool., 18, p. 360, 1912; Alexandra, Northern Territory.

Malurus lamberti occidentalis Mathews, *ib.*, 18, p. 360, 1912; Lake Way, Mid-west Australia.

Malurus lamberti mungi Mathews, *ib.*, 18, p. 360, 1912; Mungi, North-west Australia.

Malurus lamberti morgani S. A. White, Aust. Avian Rec., 1, p. 126, 1912; Lake Gairdner, South Australia.

Leggeornis lamberti hartogi Mathews, Bull. B.O.C., 39, p. 24, 1918; Dirk Hartog Island, Mid-west Australia.

Leggeornis lamberti eyrei Mellor, South Aust. Ornithologist, 6, p. 10, 1921; Eyre Peninsula, South Australia.

Range.—The interior of the continent from central-east Queensland and western New South Wales, west to coastal mid-west Australia and Dirk Hartog Island; to Borroloola in the north and Eyre Peninsula in the south.

Specimens examined.—70 from the following localities—Moora Plains, Fitzroy River and Diamantina River, Queensland; Borroloola, south of Borroloola, Northern Territory; Barrow Creek, Palm Valley, Mission Plain, James Ranges, Central Australia; Cowarie, Coopers Creek, Donalds Plain, Wertigo (Eyre Peninsula), near Ooldea, South Australia; Upper Coongan River, Fortescue River, Hammersley Range, Point Cloates, Mauds Landing, Carnarvon, Peron Peninsula, Mid-west Australia; Dirk Hartog Island.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
51 males ..	47–50 (49)	63–79 (69)	8·5–10 (9)	20–22 (20·8)
13 females ..	46–49 (47·5)	62–75 (69)	8·5–9·5 (8·8)	19·5–22 (20·3)

Subspecific characters.—Darker, but nearest to typical *lamberti* in colour of head and ear-coverts; similar to *assimilis* in colour of upper back; differs from both in upper aspect of wing being much lighter, in which respect it equals *bernieri*. Forehead and crown light methyl blue becoming smalt blue on nape, which is the colour of upper back; ear-coverts and feathers around eye pale methyl blue; outer margins of wing-quills light drab, upper wing-coverts light drab to drab, a few of the lesser series suffused with blue and some of the median tipped tawny; the white lower under surface faintly tinged cream-buff. Upper surface of female hair brown.

That specimens from such a wide area are essentially similar is not surprising since climatic conditions are very similar throughout. Apparently based on slight individual variations, the other races described from within this range are not, in my opinion, separable. It is significant that Mathews (Syst. Avium Aust., pt. 2, p. 624) has placed *mungi* as a synonym of *occi-*

dentalis although the former was described as very much darker than the latter. It is even possible that *mungi* is based on a specimen of *M. dulcis*, for the type locality (Mungi) is in very different country to that inhabited by *mastersi* and there is no other record of *lamberti* in that part of north-west Australia.

Malurus (M.) lamberti bernieri Grant.

Malurus bernieri Grant, Bull. Brit. Orn. Club, 23, p. 72, 1909 ; Bernier Island, Western Australia.

Range.—Bernier Island, Western Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
2 males ..	45–48	70–62	9–9·5	20–21
2 females ..	46–46	57–69	9	21

Subspecific characters.—Differs markedly from all other forms in the much deeper colour of head, ear-coverts, upper back and tail ; similar to *mastersi* only in the lighter upper aspect of wing and in almost entirely lacking buff colour on flanks. Forehead smalt blue deepening to blue-violet on nape, which is also the colour of the upper back ; ear-coverts and feathers around eye ultramarine blue ; tail dark delft blue. Upper surface of female mouse grey.

This is an easily recognised race, markedly different from *mastersi* on the adjoining mainland. It appears to be confined to a single island on the coast of Western Australia.

Fig. 2—Distribution.

5 *Malurus (Malurus) lamberti lamberti* ; 5a *M.(M.) l. assimilis* ; 5b *M.(M.) l. mastersi* ; 5c *M.(M.) l. bernieri* ; 6 *Malurus (M.) amabilis amabilis* ; 6a *M.(M.) a. clarus* ; 7 *Malurus (M.) dulcis* ; 8 *Malurus (M.) elegans* ; 9 *Malurus (M.) pulcherrimus.*

Malurus (*Malurus*) *amabilis* Gould.

There is no apparent reason for including *M. dulcis* as a race of *amabilis*. Of the chestnut-shouldered group, only *amabilis* is found in Cape York Peninsula, where it appears to be restricted to the east coast, except in the extreme north. The nearest locality from which *dulcis* has been recorded is King River, Northern Territory, about 800 miles to the west; the intervening country, south of the Gulf of Carpentaria, forms part of the range of *M. lamberti mastersi*. Two males and one female in the H. L. White Collection, collected at Borroloola and identified by Mathews as *dulcis*, were recorded as such and the eggs were described under that name by H. L. White (*Emu*, 14, p. 157, 1915). The skins, however, are plainly referable to *mastersi*.

Malurus (*M.*) *amabilis amabilis* Gould.

Malurus amabilis Gould, Proc. Zool. Soc., 1850, p. 277; Cape York, North Queensland.

Malurus hypoleucus Gould, Annals Mag. Nat. Hist., 19, p. 369, 1867; Cape York, North Queensland.

Range.—From Cape York south to about Cooktown, east coast of Cape York Peninsula, North Queensland.

Specimens examined.—19 from the following localities—Cape York, Somerset, Lockerbie, Piara, Watson River, and Claudie River, N. Queensland.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
14 males ..	50–53 (51·9)	49–62 (57·8)	10–10·5 (10·1)	21–22 (21·2)
5 females ..	49–52 (50·4)	51–63 (56·4)	9–10·5 (10)	20·5–21 (20·8)

Male.—Forehead to nape, ear-coverts and feathers around eye amparo blue, inclining to salvia blue on forehead; lores, a band on back and sides of neck and lower back black; upper back pale violet-blue; scapulars chestnut; wing quills except innermost secondaries fuscous-black, outer margins much lighter, those of primaries almost white, the whole suffused with varying shades of blue; lesser and median wing coverts mostly black margined bluish-gray, the outermost mottled with blue-violet; greater coverts and innermost secondaries fuscous, margins tawny; tail and upper tail-coverts violet-blue (1), central feathers narrowly, remainder broadly tipped white which continues down outer web of outermost feathers; chin, throat and breast black, a few feathers on sides of breast tipped blue-violet; abdomen white, faintly tinged buff on flanks and under tail-coverts; axillaries, under wing-coverts and inner margins of wing-quills white, faintly tinged buff. "Bill black; eyes brown; feet brownish."

Female.—Upper surface dark tyrian blue, a greenish tinge on forehead and crown; ear coverts light cerulean blue; lores and feathers around eye white; scapulars hair-brown tinged blue; wing-quills fuscous, upper wing-coverts hair-brown, those near margin of wing tinged blue and blue-violet;

tail dark delft blue, central feathers narrowly, remainder broadly tipped white which continues down outer web of outermost feathers ; under surface white, tinged cartridge buff particularly on flanks ; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills white. "Bill black ; eyes brown ; feet light brown."

The female differs markedly from that of other species of the genus in having the bill black and the upper surface dark blue. Notable in the male is the even colour of head and ear-coverts, and the very dark upper aspect of the wing.

Malurus (*M.*) *amabilis clarus*, subsp. nov.

Subspecific characters.—Differing from typical *amabilis* in the much lighter colour of head, ear-coverts and upper back. Forehead to nape, ear-coverts and feathers around eye pale cerulean blue ; upper back mazarine blue.

Type.—No. 2584, H. L. White Collection, Nat. Mus., Victoria ; ♂ ad., Cardwell, North-east Queensland, 10/8/1916 (H. G. Barnard).

Range.—From Cardwell north to about Cooktown, North-east Queensland.

Specimens examined.—15 from Cardwell, Rockingham Bay and Cairns, N.E. Queensland.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
11 males ..	50·5–53 (52)	58–62 (59·2)	10–11 (10·4)	20–22 (21)
4 females ..	49–52 (50·2)	54–60 (58)	10	20–21 (20·2)

Particularly noticeable in this race is the lack of the violet tinge on head and back so evident in typical *amabilis*.

Malurus (*M.*) *amabilis barroni* Mathews.

Malurus amabilis barroni Mathews, Nov. Zool., 18, p. 361, 1912 ; Cairns, North Queensland.

"Differs from *M. a. amabilis* in having the chestnut scapulars much darker" (Mathews).

No such difference is apparent in seven available specimens from the type locality ; all specimens from Cairns are here referred to *M.a. clarus*, new subspecies.

Malurus (*Malurus*) *dulcis* Mathews.

Malurus dulcis Mathews, Bull. Brit. Orn. Club, 21, p. 100, 1908 ; S. Alligator River, Northern Territory.

Malurus amabilis rogersi Mathews, Nov. Zool., 18, p. 361, 1912 ; Napier Broome Bay, North-west Australia.

Range.—So far as known, the western part of Arnhem Land, Northern Territory and Napier Broome Bay district, North-west Australia.

Specimens examined.—11 from the following localities—King River, Mary River, Northern Territory; Napier Broome Bay, N.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
6 males ..	49·5–51 (50·1)	53–70 (64·5)	10	19·5–22 (20·3)
4 females ..	45–50 (47·7)	61–67 (64)	10	20

Male.—Forehead light methyl blue gradually deepening on top of head to bradley's blue on nape; ear-coverts and feathers around eye pale cerulean blue; lores, a band on back and sides of neck, and lower back, black; upper back phenyl blue; scapulars chestnut; wing quills fuscous, outer margins and upper wing-coverts lighter and suffused with blue, some coverts near edge of wing mottled blue-violet; tail dark delft blue, greenish towards base and most feathers tipped white; upper tail-coverts black with lighter bases; chin, throat and breast black, a few feathers on sides of breast tipped smalt blue; remainder of under surface white, tinged bluish lavender on flanks and under tail-coverts; axillaries and under wing-coverts white, faintly tinged buff, inner margins of wing-quills cartridge buff. "Bill black; eyes dark brown; feet brown."

Female.—Upper surface dark green-blue gray, a greenish tinge on forehead and ear-coverts; lores and feathers around eye white; wings fuscous, margins of quills whitish and those of upper wing-coverts the same colour as the back; tail dark delft blue, greenish towards base and most feathers tipped white; entire under surface white, tinged cartridge buff, and indistinctly grayish on flanks; axillaries and under wing-coverts pinkish buff, inner margins of wing-quills cartridge buff. "Bill pale reddish-brown; eyes brown; feet very pale brown."

It is remarkable that this very distinct form should ever have been considered conspecific with *amabilis*. The fact that the female is not brown appears to me to be the only feature common to both. King River, Northern Territory, is the most easterly point where this species has been taken. Two males and one female from Napier Broome Bay are identical with Northern Territory specimens except that the female has the lores chestnut, not white. Mathews has figured a similar specimen as the female of *M. amabilis rogersi*, but only additional material can explain this small but important difference.

Malurus (*Malurus*) *elegans* Gould.

Malurus elegans Gould, Birds of Aust. & Adj. Islands, pt. 1, p. 2, 1837; =Swan River, Western Australia.

Leggeornis elegans warreni Mathews, Aust. Avian Rec., 3, p. 61, 1916; Warren River, South-west Australia.

Range.—Coastal S.W. Australia from King George Sound to a little north of Perth.

Specimens examined.—17 from the following localities—King George Sound, Albany, Wilsons Inlet, Warren River, near Lake Williams and Gingin, S.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
15 males ..	51–53 (52·4)	72–83 (78·4)	10	22–24 (22·9)
2 females ..	50	76–80	9	23–22

Male.—Forehead to nape, ear-coverts, feathers around eye and upper back beryl blue, appearing darker on the crown where the blackish brown bases of the feathers are evident, and lighter on the upper back, the bases of the feathers being white ; lores, a band on back and sides of neck, and lower back, black , scapulars chestnut ; wings fuscous, outer margins of quills and margins of upper wing-coverts much lighter, some of the latter tinged blue-violet ; tail and upper tail-coverts dark grayish blue-green, coverts with black bases and some tail feathers tipped white ; chin, throat and breast dusky blue-violet (2), a few feathers across lower breast black ; remainder of under surface white becoming drab on flanks and under tail-coverts ; axillaries and under wing-coverts warm buff, inner margins of wing quills almost white. "Bill black ; eyes very dark brown ; feet brownish-black."

Female.—General colour of upper surface mummy brown, bases of the feathers deep neutral gray which gives top and sides of head to nape a grayish appearance ; wings fuscous, outer margins of quills lighter, margins of the innermost secondaries and upper wing-coverts mummy brown like back ; tail dark grayish blue-green , lores burnt sienna ; under surface white, tinged buff and becoming drab on flanks and under tail-coverts ; axillaries and under wing-coverts warm buff, inner margins of wing-quills almost white. "Bill blackish brown ; eyes dark brown ; feet olivaceous brown."

This species, in the specimens examined, exhibits no racial characters at any part of its rather restricted range. The single subspecies named has since been placed in synonymy by its author (Syst. Avium Aust., pt. 2, p. 624). Notable features of the female, in contrast with other species of similar plumage pattern, are the dark, almost black, bill, the brighter colour of the lores, and the fact that the same colour does not encircle the eye.

Malurus (*Malurus*) *pulcherrimus* Gould.

Malurus pulcherrimus Gould, Proc. Zool. Soc., 1844, p. 106 ; Wongan Hills, Western Australia.

Malurus pulcherrimus stirlingi Mathews, Aust. Avian Rec., 1, p. 192, 1913; Stirling Ranges, South-west Australia.

Range.—Inland S.W. Australia from Kalgan River and Stirling Ranges north to Wongan Hills.

Specimens examined.—17 from the following localities—Kalgan River, Stirling Ranges, Gnowangerup, Gracefield, Kojonup, Gordon River and Wongan Hills, S.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
11 males ..	50–53 (51·1)	67–81 (75·5)	9–10 (9·5)	21–23·5 (23·3)
5 females ..	49–51 (50)	68–76 (72·6)	9–9·5 (9·2)	21–23 (22)

Male.—Forehead amparo blue deepening to phenyl blue on nape ; ear-coverts and feathers around eye mazarine blue tinged amparo blue ; lores, a

band on back and sides of neck and lower back black ; upper back smalt blue ; scapulars chestnut ; wing quills fuscous, whitish on outer margins, upper wing-coverts hair brown, margins of innermost tawny ; tail and upper tail-coverts deep grayish blue-green, some tail feathers tipped white and some coverts black ; chin, throat and breast dusky blue-violet (2), a few feathers across lower breast tipped black ; remainder of under surface white, tinged buff on flanks and under tail-coverts ; axillaries and under wing-coverts warm buff, inner margins of quills whitish. "Bill black ; eyes dark brown ; feet very dark brown."

Female.—Upper surface olive-brown, a grayish tinge on forehead and sides of face and neck ; wing quills fuscous, whitish on outer margins ; upper wing-coverts hair-brown ; tail and upper tail-coverts deep grayish blue-green, some coverts tinged olive-brown ; lores and feathers around eye chestnut ; chin, throat and breast pale smoke gray merging into buffy brown on flanks and under tail-coverts ; centre of abdomen white, faintly tinged buff ; axillaries and under wing-coverts warm buff, inner margins of wing-quills whitish. Bill chestnut-brown. "Eyes and feet dark brown."

In common with *M. elegans*, the throat and breast of this species is blue-violet as distinct from the black of these parts in the remainder of the chestnut-shouldered group. A mere strip of country on the line of 20 inch rainfall, between Wongan Hills and the Stirling Ranges, appears to be the extent of its range. The author of the only subspecies named has since consigned it to synonyomy (Syst. Avium Aust., pt. 2, p. 625).

The inclusion here by recent authors of *Leggeornis lamberti eyrei* Mellor appears to me unwarranted. Described from two specimens taken more than 1000 miles east of the known range of *pulcherrimus*, *eyrei* appears to have been properly included by Mellor under *lamberti*. The only difference that he noted was that the two specimens exhibited a bluish tinge on the throat in *some* lights. This slight variation is quite compatible with *lamberti*, but it does not approach the blue-violet on the throat and breast of *pulcherrimus* which is more pronounced than in any other similarly marked species.

Subgenus Hallornis Mathews.

Hallornis Mathews, Aust. Avian Rec., 1, p. 113, 1912. Type, *Malurus cyanotus* Gould.

Ryania Mathews, *ib.*, 1, p. 113, 1912. Type, *Muscicapa melanocephala* Latham.

Nesomalurus Mathews, *ib.*, 2, p. 59, 1913. Type, *Malurus edouardi* Campbell.

Malurus (*Hallornis*) *leuconotus* Gould.

Malurus leuconotus Gould, Proc. Zool. Soc., 1865, p. 198 ; South Australia (interior).

Malurus leucopterus (not Dumont, 1824) Vigors and Horsfield, Trans. Linn. Soc., 15, p. 222, 1827 ; New South Wales (interior).

Malurus cyanotus Gould, Handbook of the Birds of Aust., 1, p. 331, 1865 ; New South Wales (interior).

Malurus cyanotus exsul Mathews, Nov. Zool., 18, p. 359, 1912 ; Yule River, Mid-west Australia.

Malurus leuconotus perplexus Mathews, *ib.*, p. 359, 1912 ; Day Dawn, Mid-west Australia.

Malurus cyanotus diamantina H. L. White, Emu, 18, p. 121, 1918 ; Diamantina River, Western Queensland.

Hallornis leuconotus wongani Mathews, Birds of Aust., 10, p. 83, 1922 ; Wongan Hills, Western Australia.

Range.—From south-west Queensland, the interior of New South Wales and north-west Victoria west to the coast of mid-west Australia.

Specimens examined.—67 from the following localities—Diamantina River, W. Queensland ; Buckingay, Riverina, New South Wales ; Swan Hill, Raak, Kow Plains, N.W. Victoria ; Hermannsburg, James Range, Finke River, Central Australia ; Coopers Creek, Mungeranie, Mt. Lyndhurst, Ooldea, Haig, South Australia ; Naretha, Lake Way, Nullagine, Upper Coongan River, Cossack, Fortescue River, N.W. Cape, Point Cloates, Mauds Landing, Peron Peninsula and Carnarvon, Western Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
50 males ..	44–50 (46·8)	55–68 (61)	8–9·5 (8·7)	18–20 (19)
10 females ..	44–46 (45)	57–65 (60)	8–9 (8·6)	18–19 (18·5)

Male.—Entirely phenyl blue except scapulars, wings and tail ; scapulars, innermost secondaries and inner upper wing-coverts white ; remainder of wing fuscous, upper-coverts tipped or margined phenyl blue, outer margins of wing-quills bluish gray ; tail dusky greenish-blue, margins of outer webs of feathers lighter and of inner webs fuscous ; axillaries and under-wing-coverts black excepting those of the latter at edge of wing which are blue, inner margins of wing quills noticeably lighter. "Bill black ; eyes deep brown ; feet dark brown."

Female.—Upper surface, including upper wing-coverts wood-brown ; wing quills hair-brown, outer margins of secondaries wood brown and those of primaries much lighter ; tail drab, indistinctly suffused with blue and lighter on margins of outer webs ; lores and under surface white tinged cartridge buff, particularly on flanks and under tail-coverts ; axillaries, under wing-coverts and inner margins of quills pinkish buff. "Bill pink horn ; eyes umber ; feet light brown."

The validity of *leuconotus* as distinct from *leucopterus* Vigors and Horsfield =*cyanotus* Gould (not *leucopterus* Dumont) has long been doubted. The type has been lost and no other specimen was recorded until 1924 when Kinghorn and Iredale (Emu, 24, p. 59) published an account of one taken at Mount Lyndhurst, South Australia, agreeing with the original description. This specimen (which I have had the opportunity to examine) exhibits a tinge of blue, especially towards the tips,

in some of the white feathers of the upper back, and there are one or two white, or partially white, feathers evident in the blue of the crown and nape. In the series examined there are two specimens, collected on the same date, at Buckingay, New South Wales ; one is typical *cyanotus*, while the other approaches *leuconotus* in having the long feathers of the upper back white, or grayish white, broadly tipped blue, and the uppermost feathers of the lower back distinctly white tipped blue. In four other examples from further inland a limited amount of white is apparent on the upper surface apart from the scapulars and innermost secondaries. In view of the foregoing, it appears to me evident that there is only one species ; specimens having the back entirely or partially white are merely evidence of pronounced variation within the species. A further extreme example is the single male for which H. L. White proposed the name *diamantina*. It is one of a number of specimens from various localities which exhibit a "bleached" appearance to a varying degree. The other forms named are based apparently on individual variation. *M. leuconotus perplexus* was described when Mathews accepted two distinct species, and it must have been based on a specimen having the back blue (*M. cyanotus*), not white (*M. leuconotus*). Unfortunately, the name *leuconotus* has priority over the much more suitable *cyanotus*.

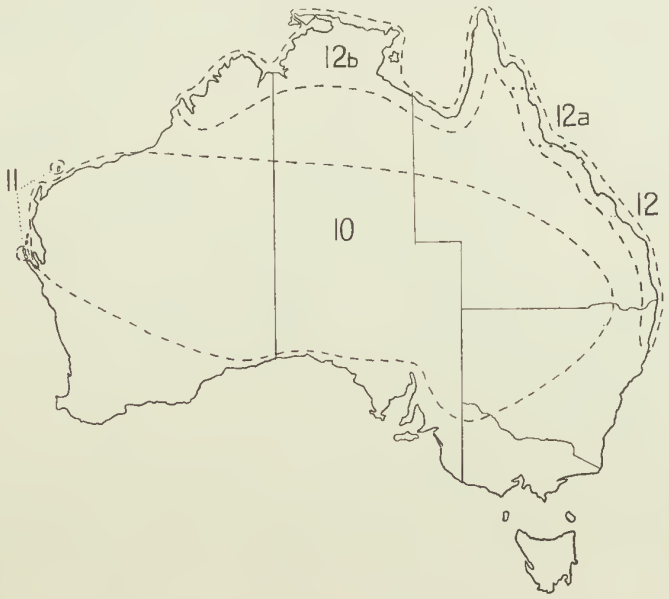


Fig. 3—Distribution.

10 *Malurus (Hallornis) leuconotus*; 11 *Malurus (H.) leucopterus*; 12 *Malurus (H.) melanocephalus melanocephalus*; 12a *M.(H.) m. pyrrhonotus*; 12b *M.(H.) m. cruentatus*.

Malurus (*Hallornis*) *leucopterus* Dumont.

Malurus leucopterus Dumont, Dict. Sci. Nat., 30, p. 118, 1824 ; Dirk Hartog Island, Western Australia.

Malurus edouardi Campbell, Vic. Naturalist, 17, p. 203, 1901 ; Barrow Island, Western Australia.

Range.—Dirk Hartog Island and Barrow Island, Western Australia.

Specimens examined.—43 from both islands.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
29 males ..	43–46 (44·8)	56–64 (59)	8–9 (8·7)	18–20 (19)
9 females ..	42–45 (43·9)	55–60 (58·7)	8–9 (8·6)	18–19 (18·7)

Male.—Entirely glossy black with greenish-blue reflections, except scapulars, wings and tail ; scapulars, innermost secondaries and inner upper wing-coverts white ; remainder of upper wing-coverts fuscous-black tipped or margined glossy black ; primaries and remainder of secondaries fuscous with outer margins bluish white, darkest on inner secondaries ; tail hortense blue ; under wing-coverts black, inner margins of wing-quills noticeably lighter. "Bill black ; eyes deep brown ; feet blackish brown."

Female.—Upper surface drab ; ear-coverts and sides of neck light drab ; wings fuscous, outer margins of wing-quills lighter, from drab on innermost secondaries to pale drab-gray on primaries ; lesser and median upper wing-coverts tipped pale drab-gray like outer margins of greater series and wing-quills ; tail grayish-blue green, suffused with drab and some outer feathers tipped white ; lores and under surface white becoming avallaneous on flanks and under tail-coverts ; under wing-coverts pinkish buff, inner margins of quills light drab. "Bill dull red, fleshy white at base ; eyes dark hazel ; feet brownish purple."

Although the two islands inhabited by this species are about 500 miles apart, specimens from both, in the representative series examined, are inseparable. It has been stated that the males differ in the colour of tail and thighs (tibia), but this is plainly due to state of plumage. In an otherwise fully plumaged male the thighs may be drab or grayish as in the female, the tail brownish or greenish-blue, and the under wing-coverts pinkish buff, not black. Available specimens show various stages from drab immature up to fully plumaged adult males which have the tail hortense or dusky blue, and the thighs and under wing-coverts black. The tail, in examples from both islands, varies considerably and it is difficult to state a single colour that is approached by all. Some females from Barrow Island have the upper surface deeper or richer in colour than those from the type locality, but this is not a constant feature.

In the series examined five males from Dirk Hartog Island and one from Barrow Island show a limited amount of blue, similar to the blue of *M. leuconotus* of the mainland, in the otherwise black feathers of the under surface ; this colour is

in the form of a subterminal bar to the feathers about the middle of the lower breast.

Malurus (*Hallornis*) *melanocephalus* Latham.

The range of this species is entirely coastal, extending from north-eastern New South Wales around the north of the continent to Derby in the north-west. This is the only wren found on the coast of Queensland between Cardwell and Rockhampton, which localities form the southern and northern limits respectively of the range of many species. There are three recognisable races varying markedly in colour of the back and slightly in size.

Malurus (*H.*) *melanocephalus melanocephalus* (Latham).

Muscicapa melanocephala Latham, Index Orn. Sup., p. 52, 1801 ; New South Wales.

Sylvia dorsalis Lewin, Birds, New Holl., pl. XIV, 1808 ; Patterson New South Wales.

Malurus browni Vigors and Horsfield, Trans. Linn. Soc., 15, p. 223, 1827 ; Thirsty Sound, South Queensland.

Range.—North-eastern New South Wales, north probably to about the Burdekin River, E. Queensland (coastal).

Specimens examined.—21 from the following localities—Bellenger River, Grafton, Richmond River, Tweed River, N.E. New South Wales ; Moreton Bay, Moora Plains and Mackay, E. Queensland.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
15 males ..	43–49 (45·2)	45–58 (50·6)	9	18–20 (19)
6 females ..	41–47 (43·1)	52–66 (56·3)	8–9 (8·8)	17–20 (18·8)

Male.—Entirely velvety black with deep blue reflections, except wings, scapulars and back ; scapulars and back from neck to upper tail-coverts grenadine red ; wing-quills fuscous, innermost secondaries slightly darker ; upper wing-coverts black excepting inner webs of greater series which are fuscous ; axillaries and under wing-coverts black, inner margins of wing quill noticeably lighter. "Bill black ; eyes dark brown ; feet light brown."

Female.—Upper surface, including upper wing-coverts, drab, tinged tawny olive on lower back and upper tail-coverts ; ear-coverts and sides of neck light drab ; wing-quills hair-brown, outer margins much lighter, particularly those of the primaries ; tail sepia, feathers lighter on margins of outer webs ; lores and under surface white tinged buff, becoming pinkish buff on flanks and under tail-coverts like the under wing-coverts and inner margins of wing quills. "Bill dark horn ; eyes umber ; feet light brown."

Easily distinguished from the two northern races by the distinct orange (grenadine red) colour of the back and the lighter upper aspect of the wing.

Malurus (*H.*) *melanocephalus pyrrhonotus* Mathews.

Malurus melanocephalus pyrrhonotus Mathews, Nov. Zool., 18, p. 362, 1912 ; Cairns , North Queensland.

Range.—From south of Cardwell to north of Cairns, N.E. Queensland.

Specimens examined.—15 from Cairns and Cardwell.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
13 males ..	43–45 (44)	43–51 (46·4)	9	18–20 (18·9)
1 female ..	42	54	9	19

Subspecific characters.—Intermediate between typical *melanocephalus* and *cruentatus* in colour of back which is scarlet to scarlet-red, and averaging slightly less than the former and more than the latter in length of wing and tail. Similar to *cruentatus* in having innermost secondaries almost black.

The range indicated, owing apparently to climatic conditions, is rich in distinct forms of many species. Specimens from Cairns are slightly deeper in colour on the back than those from Cardwell, but are still widely different in that respect from *cruentatus*, to which examples from Claudie River and Coen are plainly referable.

Malurus (*H.*) *melanocephalus cruentatus* Gould.

Malurus cruentatus Gould, Proc. Zool. Soc., 1839, p. 143 ; =Port Essington, Northern Territory.

Malurus cruentatus boweri Ramsay, Proc. Linn. Soc., N.S.Wales, 1, p. 1100, 1886 ; Derby, North-west Australia.

Malurus melanocephalus melvillensis Mathews, Aust. Avian Rec., 1, p. 45, 1912 ; Melville Island, Northern Territory.

Range.—Northern coast of Australia from north of Cairns, N.E. Queensland to Derby, N.W. Australia ; Groote Eylandt and Melville Island.

Specimens examined.—41 from the following localitics—Claudie River, Coen, N. Queensland : Borroloola, Brunette Downs, Groote Eylandt, King River, Flora River, Darwin, E. Alligator River, Northern Territory ; Napier Broome Bay, Leopold Downs, Fitzroy River and Derby, N.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
27 males ..	41–45 (42·8)	39–47 (42·6)	9	18–19 (18·7)
7 females ..	41–45 (42·8)	45–63 (54·1)	9	18–19 (18·7)

Subspecific characters.—Differs from both other forms in the much deeper colour of back which is nopal red, and in averaging less in length of wing and tail. Similar to *pyrrhonotus* in having innermost secondaries almost black.

Specimens from Derby are slightly deeper in colour on the back, but the difference is too slight to be considered of subspecific value. The original description of *M. c. boweri* is that

of a male about mid-way through the process of changing plumage. The author of *M. m. melvillensis* has recently consigned that name to synonomy. (Syst. Avium Aust., pt. 2, p. 625.)

Subgenus Rosina Mathews.

Rosina Mathews, Aust. Avian Rec., 1, p. 113, 1912. Type, *Malurus coronatus* Gould.

Malurus (*Rosina*) *coronatus* Gould.

A distinctive species, but one of the least known of the genus. Its range appears to be a narrow inland belt of country extending eastward across northern Australia from the Fitzroy to the Leichardt River. Though invariably accepted as much the largest of the genus, it is equalled in all but length of culmen by *M. elegans.*

Malurus (*R.*) *coronatus coronatus* Gould.

Malurus coronatus Gould, Proc. Zool. Soc., 1857, p. 221; Victoria River, Northern Territory.

Rosina coronata rogersiana Mathews, Birds of Aust., 10, p. 129, 1922; Derby, North-west Australia.

Range.—From the Victoria River district, Northern Territory, south-west to the Fitzroy River, N.W. Australia (inland).

Specimens examined.—8 from the following localities—100 miles east of Wyndham (near type locality), Fitzroy River and Derby (? inland), N.W. Australia.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
4 males ..	54·5–57 (55·2)	75–84 (80·2)	11	23–24·5 (24)
4 females ..	52·5–55 (53·7)	78–83 (80·2)	11	23

Male.—Forehead to nape, except centre of crown, hortense violet; lores, centre of crown, above and below eye, ear-coverts and a band on back and sides of neck black; remainder of upper surface including most upper wing-coverts buffy brown tinged tawny olive; wing quills and upper coverts near edge of wing hair-brown, margins of former buffy brown and of latter bluish white; tail and upper tail-coverts bluish gray-green, tail feathers tipped white, the lateral ones white on margins of outer web; centre of under surface white faintly tinged buff merging into pinkish buff on sides of body and under tail-coverts; under wing-coverts pinkish buff, whitish near edge of wing, inner margins of wing-quills cartridge buff. "Bill black; eyes dark brown; feet horn colour."

Female.—Upper surface including most upper wing-coverts buffy brown tinged tawny olive, except forehead which is tinged blue, giving a grayish appearance; wing-quills and upper coverts near edge of wing hair-brown, margins of the former buffy brown and of the latter bluish white; tail and

upper tail-coverts bluish gray-green, tail feathers tipped white, the lateral ones white on margins of outer web ; lores, feathers around eye and a supraloral stripe, which terminates behind the eye, white ; feathers of lores immediately in front of eye tipped black ; ear-coverts bay ; centre of under surface white, faintly tinged buff, becoming pinkish buff on sides of body and under tail-coverts ; under wing-coverts pinkish buff, whitish near edge of wing, inner margins of wing-quills cartridge buff. "Bill nearly black ; eyes brown ; feet pale horn."

Although two of the specimens examined are labelled as from Derby, and a subspecies has been described with that place as the type locality, this form nowhere approaches the coast. No recent collector has recorded it from the coastal area. A single fully plumaged male from Derby (?) has the head much lighter (more pinkish) than typical specimens, and in that respect is the opposite of the subspecies described. Fitzroy River specimens taken 140 miles inland are, however, typical *coronatus*.

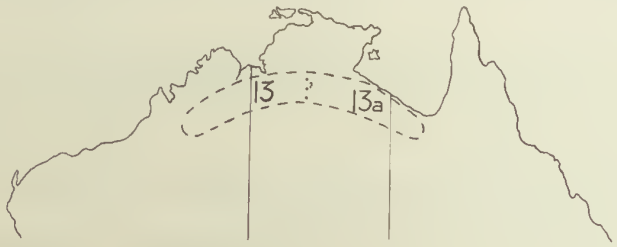


Fig. 4—Distribution

13 *Malurus (Rosina) coronatus coronatus ;*
13a *M. (R.) c. caeruleus*

Malurus (R.) coronatus caeruleus subsp. nov.

Subspecific characters.—Differs from typical *coronatus* in much darker colour of back ; from the black band on hind neck to upper tail-coverts is more drab distinctly tinged blue, particularly on mantle the feathers of which are tipped grayish blue. Female markedly different in colour of head which is dark delft blue on forehead, becoming lighter on crown and merging into the buffy brown of the upper surface on hind neck ; white feathers of lores immediately in front of eye are broadly tipped black, forming a distinct spot.

Type.—No. 2608, H. L. White Collection, Nat. Mus. Victoria ; ♂ ad., Borroloola, McArthur River, Northern Territory, 3/2/1914 (H. G. Barnard).

Range.—From Borroloola east to Leichardt River, N.W. Queensland and west towards Victoria River, Northern Territory.

Specimens examined.—20 from the following localities—Borroloola, Pinda, Northern Territory ; Caloola, Leichardt River, N.W. Queensland.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
11 males ..	53–57 (54)	69–81 (72·9)	10·5–11·5 (11·1)	22–24 (23·4)
5 females ..	52–53 (52·2)	70–84 (74·8)	11	22–24 (23·2)

It is impossible to say how far westward this very distinct race extends until more collecting has been done between Borroloola and the Victoria River.

Malurus (*R.*) *coronatus macgillivrayi* Mathews.

Malurus coronatus macgillivrayi Mathews, Aust. Avian Rec., 2, p. 9, 1913 ; Leichardt River, North-west Queensland.

"Differs from *M. c. coronatus* in having a bluish-mauve crown to its head, not pinkish-mauve, and the black collar on the nape only indicated." (Mathews.)

It is not possible to refer any specimen here. The bluish tinge on the head and the lack of a complete black band on the hind neck suggest a specimen in the process of assuming full plumage.

THE CAINOZOIC CIDARIDAE OF AUSTRALIA.

By Frederick Chapman, A.L.S., F.G.S., Commonwealth Palaeontologist, and Francis A. Cudmore, Hon. Palaeontologist, National Museum.

Plates XII–XV.

Nearly 60 years ago Professor P. M. Duncan described the first Australian Cainozoic cidaroid before the Geological Society of London. During the next 20 years Professors R. Tate and J. W. Gregory published references to our fossil cidaroids, but further descriptive work was not attempted until the present authors undertook to examine the accumulated material in the National Museum, the Tate Collection at Adelaide University Museum, the Commonwealth Palaeontological Collection, and the private collections made by the late Dr. T. S. Hall, F. A. Singleton, the Rev. Geo. Cox and the authors.

The classification of the Cidaridae is founded mainly upon living species and it is partly based on structures which are only rarely preserved in fossils. Fossil cidaroid tests are usually imperfect. On abraded tests the conjugation of ambulacral pores is obscure. The apical system is preserved only in one specimen among those examined. The spines are rarely attached to the test and pedicellariae are wanting. Therefore, in dealing with our specimens we have been guided mainly by the appearance and structure of ambulacral and interambulacral areas. Certain features used in our classification vary with the growth stage of the test : for instance, the number of coronal plates in vertical series, the number of ambulacral plates adjacent to the largest coronal plate, and sometimes the number of granules on the inner end of ambulacral plates.

In the collections before us only one test has the spines still attached ; in another specimen, the test and a spine are only slightly separated ; and in a third a group of spines was closely associated in a block of marly limestone though the test was not collected.

Where the evidence warrants it, we have suggested that cidaroid tests and generically related unattached spines found in the same layer belong to the same species. Original colour markings of spines are sometimes recognisable, especially when specimens are thinly varnished ; this is a detail of some importance, since that feature is used in classifying recent cidaroids. Some spines, as in living examples, are encrusted with growths of parasitic polyzoa.

In the following pages five genera and eight species of Tertiary Cidaridae are recognised, including 7 new species. The only cidaroid remains recorded from pre-Cainozoic strata in Australia are portion of a test of *Cidaris comptoni* (Glauert, 1923, p. 48), cidaroid spines indeterminate (Eth. fil.) from the Cretaceous of Gingin, W.A., and a fragmentary spine of *Cidaris* sp. (Whitehouse, 1925, p. 1) from the Jurassic east of Geraldton, W.A.

The geological map of Cape Otway district, Victoria, referred to in lists of localities, is Wilkinson's, published in 1865.

Class **ECHINOIDEA.**

Order **Cidaroida** Duncan.

Family **CIDARIDAE** Gray.

Genus STEREOCIDARIS Pomel 1883.

This genus has non-conjugate pores (Mortensen, 1928) ; it was founded on fossil forms. Its history begins in the Cretaceous of Europe ; it also occurs in the Eocene of Europe and possibly of America. A fossil spine described from the Miocene of Java may also belong to this genus.

Stereocidaris is found living in the Atlantic, the Indian Ocean, the Philippine seas and around Japan. It has not been recorded from the Australian region (Clark, 1925).

Stereocidaris australiae (Duncan).

Leiocidaris australiae Duncan, 1877, p. 45, pl. III, figs. 1, 2.
? *Cidaris striata* Hutton, Tate, 1894, p. 122.
Cidaris (*Stereocidaris*) *australiae* Duncan, Tate, 1898, p. 411.

Plate XII, figs. 1–6b ; plate XV, figs. 32a, 34–36c.

Duncan's original description (1877) is as follows :—"The test is greatly and suddenly depressed towards the actinosome. The ambulacra are slightly wavy, narrow, and have four vertical rows of small miliary tubercles, the inner rows having the smallest tubercles ; and the poriferous zones are sunken, the pores being conjugate, and each pair separated from its neighbours by a distinct ridge. The interambulacral tubercles are few in number, and most are very large ; the perforate mamelon is small in relation to the plain, large, conical and well-developed boss. The scrobicule is deeply sunken, elliptical, and is overhung by the scrobicular circle which slopes down to the suture, being ornamented by radiating rows of two or three very small tubercles. The median interambulacral space is sunken, and the vertical sutures of the plates are distinctly marked by a lower space, which is in a zigzag from above down-

wards. The large upper tubercles have a smaller scrobicular area than those in the middle of the test ; and the tubercles diminish rapidly in size towards the actinosome."

Observations.—Duncan stated that the pores are conjugate, but all our specimens of this species from the type locality (Castle Cove, near Cape Otway) and from Aldinga (Port Willunga) have non-conjugate pores, a character seen in *Stereocidaris*. The pores of a pair are close together, the inner round and the outer slightly oblique.

The poriferous zone is narrow. Adult specimens have 12 ambulacral plates adjacent to the largest interambulacral plate at the ambitus. The larger ambulacral plates bear numerous tubercles and granules, comprising several vertical rows. The test is small to medium. As in recent species, the non-spine-bearing abactinal coronal plates vary considerably in number in different tests ; several of the uppermost plates often have a shallow scrobicular area, tiny in proportion to the size of the plate, with a small imperforate boss. We have found no trace of crenulation in adult specimens, but one young test from Aldinga ("C")* shows partial crenulation of the primary tubercles. Interambulacra are narrow. Scrobicules are circular, except below the ambitus, where they are slightly elliptical. Tubercles composing the ring round the scrobicules are small and the ring is inconspicuous. Scrobicules are not confluent, though in the actinal region the rings merge together. They are often far more sunken than in any other Australian Cainozoic cidaroid, but this character is variable.

The median area of the interambulacrum is very narrow in young specimens, widening with age ; in the actinal region, especially in young specimens, it is very little sunken, but pits usually occur at the ends of horizontal sutures between coronal plates. The ends of sutures nearest the ambulacra sometimes form slight grooves. There are commonly six or seven coronal plates in a vertical series ; some specimens from Aldinga with six vertical rows of tubercles in the interporiferous area have up to nine plates. The deeply sunken scrobicules and, as a rule, lack of perforate mamelons on the abactinal plates, readily distinguish this species from others included in this paper.

During the last fifty years there has been much confusion in regard to this variable cidaroid. The holotype, which came from Castle Cove (Aire Coast, Wilkinson's No. 5 Section) is in London, and we have not seen it. Tate (1898, p. 411) states that he had compared Duncan's type, "which is a single inter-ambulacral plate, with complete interambulacral zones of a

*For abbreviations see p. 142.

Cidarid from Aldinga and it is matched with the largest of the tuberculated plates of the Aldinga specimens. These latter belong to *Stereocidaris* and indicate a conic test, the broad base being nearly flat, to about one-half the total length of the arc, thence roundly bent backward at about sixty degrees ; the basal half consists of four plates in each row having areolar areas, the posterior ones of which are the largest ; the four or five anterior plates in each row are without areoles or one or two may show traces of them." Duncan's figure of the type specimen (1877, pl. III, fig. 1) shows both ambulacral and interambulacral plates ; we therefore doubt that Tate saw the actual specimen.

The latter part of the above remarks by Tate concerns a fragmentary specimen (an interambulacral zone) in the Tate Collection ; this specimen was kindly lent to us for examination (Pl. XII, fig. 3). The "basal half" is the actinal portion of the test, the "posterior" plates are those near the ambitus and the "anterior" plates are those of the abactinal region. With regard to the remark by Tate that his specimen indicated a conic test, we find that the zone, when placed in a strictly vertical position, is not so emphatically indicative of a conic test as Tate stated. We think this specimen, which he definitely places under *S. australiae*, represents a large individual in which the upper portion of the test has been crushed.

A complete test of *S. australiae* from Aldinga (Tate Collection) bears Tate's ms. name "*Goniocidaris inermis*," (Pl. XII, figs. 1, 2). The test is both abactinally and actinally depressed. Each interambulacral zone has feebly scrobiculated plates abactinally, three in left vertical series and two in right. This unique specimen also exhibits the only apical system preserved in our fossil cidaroids ; all plates are present, even the anal plate, which is depressed into the underlying matrix. *Measurements :*—diameter at ambitus, 34 mm. ; height of test, 20 mm. ; width of interamb zone at ambitus, 15 mm. ; width of amb, 3.5 mm. ; diameter of apical system, 13 mm. ; diameter of peristome, 10.5 mm. ; width of coronal plate at ambitus, 9 mm.

Two fragments of tests collected by the late Dr. T. S. Hall from the type locality are here figured (Pl. XII, figs. 5, 6b). One has six coronal plates in vertical series. Abactinal interambulacral plates have a small, shallow scrobicule with a rudimentary boss, in striking contrast to the large, deeply sunken scrobicules with perforate mamelons nearer the ambitus. *Measurements :*—abactinal portion of interamb zone ; height of test, about 19 mm. ; greatest width of interamb area, 18.5 mm. ; horizontal diameter of coronal plate at ambitus, 10 mm.

No previous workers have described spines of this species. The collections under examination comprise over three thousand Australian Cainozoic cidaroid spines, the largest number brought together at one time. From these we have selected, on morphological grounds (as well as because their range and distribution are co-extensive with tests of this species), a number which we believe to belong to the above species. Some spines of

recent species of the genus figured by Mortensen (1928, Plates XIX and XXII) are almost identical in appearance with certain of the fossil spines. Our specimens may be divided into several minor groups, which, however, shade into one another.

One variety from the lower beds at Aldinga, from Castle Cove and from Point Flinders near Cape Otway, is long, comparatively slender, and circular in section ; in some cases it is almost twice the horizontal diameter of the test in length. Length of longest spine, apex missing, from Aldinga, about 85 mm. ; a similar spine from near Cape Otway, apex missing, 63 mm. Shaft, which in the longer specimens flattens slightly towards apex, ornamented with closely set ridges bearing short spinose tubercles ; these tuberculate ridges usually extend close to apex, in which case the spine is generally slender and has an almost terete habit, but close to apex it broadens and terminates in a cup-shaped structure on exterior of which the vertical ridges become coarser and more salient. Interior of cup smooth or slightly radiately granulose. Between ridges, surface of shaft is very finely longitudinally striated ; the striae continue across neck, collar and ring.

A second variety is found at Castle Cove and in lower beds at Aldinga ; spines long, slender, with tuberculate or bluntly spinose ridges similar to those already mentioned and two coarser spinose ridges upon opposite sides of shaft ; in some the spinules coalesce to form an alate ridge. Terminations less cupped, palmate. Portion of shaft next apex flattened and sometimes curved. Both in character of spinose side ridges and of palmate termination, the second variety differs from spines of living forms and is more like certain spines of *Goniocidaris* and *Prionocidaris ;* but after examining a long series, we are satisfied that they belong to *Stereocidaris australiae*, as do the allied spines more typical of the genus. Their occurrence in a fossil species supports Mortensen's suggestion (1928, p. 230) that the Goniocidarids may have been derived from the *Stereocidaris*-like forms.

A link between the two groups of spines is provided by a third variety from near Cape Otway and from lower beds, Aldinga : more generally spinose and with palmate ending.

All these varieties have excessively fine vertical striae on surface of neck, collar and ring. Crenulation of outside of margin of acetabulum is rarely preserved.

A fourth variety tapers, and has prominent wing-like projections on either side near base (see Clark, 1925, p. 26). Near Cape Otway and at Aldinga (Tate and "C." Colls.) spines of this species are common ; at Aldinga some have narrow encircling colour bands ("C." Coll.).

Measurements.—Length of complete cup-ended spine from near Cape Otway (plesiotype), 26 mm. ; another spine, apex missing, 58 mm. ; diameter of widest cup, 9 mm. ; length of spine (plesiotype) from Aldinga, apex missing, 86 mm.

Localities.—Victoria—Castle Cove, Aire Coast, Wilkinson's No. 5 Section ("C." ; plesiotypes, 3 interamb zones, H., C.). Point Flinders, near Cape Otway, Aire Coast No. 1 Section of Geol. Surv. (Plesiotypes, 2 spines and 4 cupped terminals, C. ; also W. and "C."). Quarter mile northerly from Bird Rock, Torquay, in polyzoal rock (a small test ; "C."). Mitchell River (a test fragment ; D). South Australia—Aldinga, lower beds (Plesiotypes, interamb zone, D ; 10 spines, C ; 3 plesiotypes in Tate Coll. ; specimens in S., "C." and Tate Coll.). Wongulla, lower beds (a small test ; "C.").

Range.—Upper Oligocene to Miocene.

Genus PHYLLACANTHUS Brandt, 1835.

(Synonym : *Leiocidaris* Desor, 1855.)

This genus has primary spines cylindrical or terete, sometimes with a series of small serrations but never with thorns or projecting ridges. The pores are conjugate. (Clark, H.L. 1925).

Mortensen (1929) has recently listed five of the six known living species of this genus as inhabiting Australian seas ; he states that *Phyllacanthus* must be restricted to those species which have thick, smooth, cylindrical spines. Living species are littoral. Duncan (1877, p. 45) refers to the possible occurrence of *Phyllacanthus* in our strata. Spines from Miocene deposits of India and of Madagascar probably belong to this genus (Mortensen, 1929). *P. javanus* Martin occurs in the Miocene of Java (Martin, 1883–7) and Yule Island, Papua (Chapman and Crespin in Montgomery, 1929–30). Miss Currie (1930) has figured some spines from Late Tertiary beds of Kenya, East Africa.

Phyllacanthus duncani sp. nov.

Leiocidaris sp. nov., Duncan, 1887, Q.J.G.S., vol. 43, p. 412.

Plate XII, figs. 7–9 ; Plate XV, fig. 33.

Duncan's description of *Leiocidaris* sp. nov. is as follows :—

"The ambulacrum is rather undulating and narrow ; the poriferous zone is very slightly sunken ; the pores are large ; the outer one of a pair is the larger and elliptical ; the inner or adoral is round ; they are united by a groove, and about seventeen pairs are in relation to a large interradial coronal plate. Interporiferous area with a row of small, imperfect secondaries, with slightly raised scrobicules and a small boss, no mamelon, placed close to the poriferous zone, and a series of smaller secondaries nearer the median line, in a vertical row extending along the middle of the area, but not reaching much actinally or far towards the apex. The primaries of the interradia are large ; the scrobicules are distinct, nearly circular, and there is a row of small secondaries and a few granules between them and the horizontal sutures of the plates. The boss is broad at the base and conical, and the mamelon is contracted at the neck and is perforated. There is no crenulation. The margin of the scrobicular circle is sunken, and is surrounded by a row of small secondaries made up of an elongated raised scrobicule, longest transversely, and a small boss ; there are a few smaller tubercles placed beyond the circle, and fitting in between the larger, so as to complete the circle, and a few exist beyond it. Two or three rows of still smaller tubercles extend along the plates beyond the circle towards the median line, and the median area of the interradium is narrow. Numerous spines are in the collection, and the large and nearly smooth ones may be associated with this genus."

Observations.—We have named this form after the late Prof. P. M. Duncan, whose description we have quoted above, and have referred it to *Phyllacanthus,* of which *Leiocidaris* is a synonym, being guided partly by the nature of the spines.

The tests are medium to large, tall and a little depressed abactinally. The poriferous zone is distinctly sunken and pores are not close together. Ambulacral plates show two, three, or even four vertical rows of tubercles ; a fourth row occurs on a large imperfect test from Port Macdonnell which was at first thought to represent a distinct species, but its large size appears to be merely a feature of senility. At Batesford there occur coronal plates (25.5 mm. by 14 mm.) from tests which were even larger. Coronal plates in the vertical series are probably seven in number. Interambulacral zones from Bairnsdale, whence came the original specimen, and from Batesford, show that the median area at the ambitus is broad, with plate margins sloping slightly down to the suture. The scrobicular rings do not overhang the scrobicules ; the latter are nowhere confluent, though the rings merge in the actinal region. The area beyond the rings is covered with closely-packed miliaries.

J. W. Gregory (1890, p. 482) has recorded this species from Willunga, South Australia, but the fossil probably came from Port Willunga on Aldinga Bay. Unless the fragment came from the upper bed, it almost certainly represents the new species now named *Prionocidaris scoparia*.

Neither Duncan nor Tate figured cidaroid spines. Some spines from the same stratum as the tests of *Phyllacanthus duncani* are undoubtedly conspecific ; they are all fairly long, very gradually tapering, without thorns, somewhat rounded at the end, with a moderately blunt point. Minor characters divide them into two varieties which we have never found together in the same bed. There is no variation in the tests, and possibly further collecting may show that differences in the spines are due either to their range in time or to factors of environment.

In the first kind, ring is milled by fine lines which cross it vertically ; above ring shaft narrows, then widens before tapering towards apex, maximum width being sometimes greater than diameter of ring. Shaft covered with fine granules, irregularly scattered near neck, but a little above it arranged in straight lines, giving blunt apical portion a ridged or fluted appearance. Viewed under high magnification, remainder of the surface is a network of fine cells. *Localities.*—Victoria—Mitchell River at Bairnsdale (N.M., "C." and "G.C."). Swan Reach ("G.C."). Nicholson River ("C."). Curlewis, locality Ad 12 or 13, Geol. Quarter Sheet 23 SW. (N.M.). Beaumaris, washed out into the shingle ("C."). South Australia—Beach at Port Macdonnell ("H."). Aldinga, upper beds (no narrowing or swelling of spines; "C."). Upper beds near Morgan, Murray River ("C.").

Spines of second kind have no constriction above collar. Granules coarser, linearly arranged nearer neck. The network of cells visible only in exceptionally well-preserved specimens. Diameter of shaft rarely as much as that of ring ; spine tapers evenly to blunt end.

Localities.—Victoria—Batesford (N.M., "H.," "C."). Flinders (N.M., "C."). Knight's Bridge, Moorabool River, near Maude, TM 1–4 (N.M.). Kawarren ("H."). "Upper Coralline beds" at No. 3 of Wilkinson, between Castle Cove and Eagle's Nest Rock, Cape Otway district (N.M., "C."). Green Gully, Keilor (N.M.). Clifton Bank, Muddy Creek, Hamilton (2 worn spines, "H."). Tasmania—Table Cape, lower beds ("C."). Cape Barren Islands, Flinders Group, Bass Strait (Geol. Surv. Tas. Coll., Hobart).

In cross-section spines are practically round: unabraded specimens distinctly granulose, but where successive coats have peeled off, slightly different structures are revealed. Outer coat may carry coarse granules in longitudinal lines and inner coat fine granules similarly arranged. Specimens further abraded are smooth. Internal structure revealed by thin sections is characteristic of the genus *Phyllacanthus* (cf. Mortensen, 1928, p. 502, fig. 162). In one spine from Batesford ("C.") shaft is flattened near apex.

Measurements.—Holotype (imperfect test from Batesford); width of interamb area at ambitus, 27 mm.; height of test, about 42 mm. Plate in region of ambitus; diameter, 15 mm.; height, 10.5 mm.; horizontal diameter of boss, 9 mm. Paratype (imperfect test); vertical series of three uppermost abactinal interamb plates, 33 mm.; greatest width of interamb zone, 39 mm.; horizontal diameter of largest plate, 19 mm. Spines:—length of longest spine, figured as a paratype, 59 mm.; diameter of ring, 5 mm.; width near tip, 2 mm.

Localities.—Victoria—Batesford; "H.," "C." and "F.A.S."; holotype, interamb zone (M.); paratypes, abactinal portion of interamb zone (H.) and 5 spines (C.). Waurn Ponds, Geelong ("C."). Curlewis polyzoal limestone (N.M. and "C."). Bird Rock Cliffs, Torquay (N.M.). Airey's Inlet ("C."). Maude, locality WTM 1–4 on Geol. Surv. map (N.M.). Left bank of Moorabool River, Lethbridge ("C."). Flinders (N.M., "G.C.," "H.," "C."). Green Gully, Keilor (N.M.). Bairnsdale (N.M., "H." "C.," "G.C."). Nicholson River ("C."). Swan Reach ("G.C."). Swan Reach, upper and lower beds ("C.P.C."). Toorloo Creek, Lake Tyers (Ashburner Coll.). Mississippi Creek, Lakes Entrance ("C.P.C."). Rosehill Farm, Mitchell River ("C."). Kawarren ("H."). Bowker's Steps, Princetown (D.). Calder River limestones, Hordern Vale, Cape Otway district ("C."). Aire Coast, polyzoal limestone at locality Wilkinson's 3AW (W., "C."). Beaumaris (washed into shingle; "C."). Clifton Bank, Muddy Creek, Hamilton (several worn spines, record uncertain; "F.C.," "C."). Balcombe Bay, Mornington (one spine; N.M.). South Australia—Port Macdonnell (paratype, interamb zone (H.); also spines, "H." Aldinga, upper beds ("C."). First cliff north of "Brittana," 3 miles below Morgan, upper beds ("C."). Tasmania—Table Cape, upper and lower beds ("C."). Cape Barren Islands, Flinders Group, Bass Strait, in polyzoal limestone (Geol. Surv. Tas. Coll., Hobart). Western Australia—Booanya, near Balladonia (N.M., pres. Miss A. E. Baesjou).

Range.—Upper Oligocene to Lower Pliocene.

Genus PRIONOCIDARIS A. Agassiz 1863.

This Indo-Pacific genus is represented around the Australian coast by three living species, in the main littoral (Mortensen, 1929). Primary spines are often very diverse (Clark, 1925). Pores are conjugate. Mortensen states that various species, ranging from the Cretaceous of Europe and the Eocene of

Europe and of India to the Miocene of Europe, probably belong to *Prionocidaris*, though none is placed by their authors in that genus.

Prionocidaris scoparia sp. nov.

Plate XII, figs. 10, 11 ; Plate XV, figs. 28–30.

Test large, tall and slightly depressed abactinally. Ambulacrum narrow and wavy, ambulacral plates usually with two vertical rows of small miliary tubercles, making four rows present in interporiferous area ; poriferous zone slightly sunken ; pores conjugate, oval, close together. About fifteen ambulacral plates adjacent to largest interambulacral plate. Seven coronal plates. Boss broad, uncrenulated, with perforate mamelon slightly contracted at neck. Scrobicules shallow, circular towards apex, elsewhere elliptical. Scrobicular circle bounded by a ring of tubercles which does not overhang margin of scrobicule. Except in abactinal region, the rings merge together ; between scrobicules near actinosome they tend to disappear. Median area of interambulacra very narrow, even near ambitus ; only slightly depressed at suture ; covered with closely packed miliaries of unequal size. No pits or grooves in horizontal or vertical sutures.

Remarks on Tests.—The syntype from Mt. Gambier, in common with other specimens which we have seen, shows that the test is large and high ; in the syntype from Aldinga the test is nearly complete but considerably flattened by crushing in situ (Pl. IX, fig. 10). Fortunately a spine has been preserved on this test ; it lies across the apex not far from the mamelon from which it was detached. This spine corroborates our earlier determination of isolated spines of this species.

Measurements.—Syntype (interamb zone), from Knight's Railway Siding Quarry, Mt. Gambier, S.A. (Mines Dept. Vict. Coll.) :—height of test, about 64 mm. ; width of interamb area at ambitus, 38 mm. ; width of interamb plate in region of ambitus, 21 mm. ; height of plate, 12 mm. ; width of amb plate, 3.5 mm. Syntype from Aldinga, lower beds (Tate Coll.) : a nearly complete test. Present diameter of test, 75 mm. ; height, considerably reduced by crushing, 32 mm. ; diameter of apical system, about 20 mm. ; diameter of peristome, about 22 mm. ; width of amb, 8.5 mm. ; width of interamb area at ambitus, 38 mm. ; width of interamb plate in region of ambitus, 20 mm. Spine without apex lying on test 38 mm. long ; base to end of collar, 8 mm. ; diameter of ring, 6 mm. ; greatest diameter of shaft, 5 mm.

Spines long, stout, slightly tapering, usually cylindrical ; some widened and much flattened on both sides towards apex. Ring finely milled ; diameter much greater than that of shaft ; no narrowing of shaft above ring. Shaft ornamented with thorns, all long or all short, scattered or arranged linearly. Extremely fine granules cover shaft between thorns. Spines with rounded shafts have apex flared, forming depression surrounded by pointed terminals of granular ornament of spine. Flattened spines have no terminal depression ; apex composed of projections of ornament ; shaft terminates as though cut across at 45 degrees to its length. *Localities.*—Waurn Ponds, Nelson, Mount Gambier and lower beds, Aldinga.

Measurements.—Paratypes (spines), both from lower beds, Aldinga : length of thorn-bearing spine, tip imperfect, 100 mm. ; width at ring, 6 mm. , width

of shaft near tip, 4 mm. Complete spine with shorter thorns, length 87 mm.; width at ring, 9 mm.; width of shaft near tip, 4.5 mm. Fragmentary flattened spine showing terminal, lower beds, Aldinga (Tate Coll.); thickness, 3.25 mm.; minimum width, 6.5 mm.; maximum width, 9.25 mm.

Observations.—Prionocidaris scoparia has the narrow interambulacrum found in recent species. In young specimens the median area of the interambulacrum is very small; it becomes larger as the test grows, but even in adults it is relatively narrow. In a young test from Aldinga primary tubercles are partially crenulated. Lyman Clark states that the interambulacra in recent species are not densely clothed with miliaries.

Though fragments of tests of *P. scoparia* are difficult to distinguish from those of *Phyllacanthus duncani*, the latter species has a wider interambulacral median area, more sunken scrobicules, and pores of a pair more widely separated. So far we have not seen both species from the one horizon, though in a few cases both occur in the one locality.

Localities.—Victoria—Castle Cove, Aire Coast, Wilkinson's locality No. 5AW. Allotment 14, Parish of Wataepoolan ("C.P.C."). Waurn Ponds ("H.," "C."). Nelson ("H."). South Australia—Aldinga, lower beds; S., "C."; paratypes, 4 spines, C. and 4 fragmentary spines, S.; syntype and paratype (spine), Tate Coll. Knight's Railway Siding Quarry, Mt. Gambier ("C.," "F.C."; syntype, N.M.). Morgan, lower beds ("C.," a young specimen ?).

Range.—Upper Oligocene to Miocene.

Genus GONIOCIDARIS L. Agassiz and Desor 1846.

Living species of *Goniocidaris* are confined to Australasian seas; *G. tubaria* is mainly a littoral form, but *G. australiae* has been found down to 470 metres. The genus is well represented in our Cainozoic rocks. The main distinguishing characters are the conspicuous bare sunken areas of the ambulacrum and of the interambulacrum, and the pits in the latter. Pores are non-conjugate (Clark, 1925, and Mortensen, 1928). In other parts of the world various fossils have been referred to this genus, but the only examples which, we believe, may belong to it occur in the Miocene of India and in the Miocene and Pliocene of the Persian Gulf.

Goniocidaris prunispinosa Chapman and Cudmore.

Plate XIII, figs. 12–14.

Goniocidaris prunispinosa Chapman and Cudmore, in Chapman, 1928, p. 90.

The following description is amplified and emended from our preliminary description.

Holotype (test from Morgan, S.A., with spines still attached). Test small and low in proportion to width. Ambulacra very slightly wavy. Ambulacral plates level, with two vertical rows of small miliary tubercles which consist of boss and mamelon; on each plate the tubercle nearest poriferous zone is the larger; the smaller tubercle placed at 45 degrees downwards from the larger; median suture visible; margin of plate slopes slightly downwards towards suture. Poriferous zones sunken. Pores non-conjugate, circular, close together, adjoining pairs separated by a pronounced ridge. Six ambulacral plates adjacent to largest interambulacral plate. Interambulacra rather broad. Seven coronal plates; serobicules sunken, elliptical, becoming circular near apex; boss conical, uncrenulated; mamelon perforate, contracted at base. Plates against apex not divided from adjacent plates below by wide horizontal sutures or grooves. Marginal area of plates nearest poriferous zones covered with miliaries varying in size and irregularly arranged; portion sloping down to median interambulacral suture covered with scattered miliaries which diminish regularly in size towards suture. Suture a slightly zigzag line. Tubercles around scrobicule not noticeably arranged into a ring, but margin overhangs serobicule. Scrobicules not confluent; separated only by thin margin in actinal region. Median area of interambulacra broad.

Spines still attached to test slender, with basal ring finely ridged; shaft slender, cylindrical, tapering towards apex; surface ornamented with prominent, upwardly directed spinules, often arranged in longitudinal lines but in some instances irregularly scattered; in one example tip distinctly flared into cup-shaped ending.

Measurements.—Holotype; diameter of peristome, about 12 mm.; diameter of test, 29 mm.; height of test, 16 mm.; width of interamb zone, 15 mm.; width of amb, 4.5 mm.; width of coronal plate at ambitus, 8 mm.; height of plate, 4.5 mm. Attached spines: length, 21 mm.; thickest part of shaft, 2 mm.; diameter of flared tip, 4.5 mm.

Observations.—This species lacks some characters of the recent genus *Goniocidaris* and may eventually be separated from it. The median suture of the interambulacra, although occupying a depressed area, is not bare and shows no sign of pits. In the ambulacra there are no bare areas between the two rows of miliaries on either side of the suture.

Crenulated bosses, though absent from the holotype, are occasionally present on other specimens. For instance, under the microscope one interambulacral zone shows that bosses nearest the actinosome are crenulated, and those on a few of the many separated plates, probably from near the ambitus, are more plainly crenulated; half the circumference of the platform of the boss remains smooth.

Spines more slender than those of living species, but have characters typical of the genus. Chiefly long, slender, delicate with fairly distant, usually very sharp, spinules. Shaft rounded to elliptical; spinules emerge at angles ranging from vertical to acute. One variety carries coalescent thorns forming a wing on each side of spine; another clothed closely with short stout thorns; in a third thorns coalesce to form sheath at tip of spine; one side of shaft often bare of spinules; in others, short spinules are arranged in straight lines and they diminish in size towards apex. Surface finely striated in well-

preserved specimens. Many specimens from Balcombe Bay have flared, cup-shaped spinal endings; margin of cup finely striated. Some very short spines (11.5 mm.) are strongly forked with four or five terminal prongs. Some spines from Balcombe Bay ("C.") and Murgheboluc ("C.") retain traces of encircling colour bands.

Localities.—Victoria—Balcombe Bay ("C.," N.M.; paratypes, 17 spines, C.). Grice's Creek ("C."). Altona Bay Coal Shaft ("C."). Sorrento Bore (N.M., depths 995, 1034, 1310, 1340, 1376, 1490, 1580 and 1667 feet). Gellibrand ("H.," "C."). Fischer Point, Aire River ("C."). Orphanage Hill, Fyansford (N.M., "C."). Red Hill, Shelford ("H.," "C."). Murgheboluc, near Bannockburn, Geelong district ("C."). Native Hut Creek ("C."). Waurn Ponds ("C."). Ocean Grove ("C."). Left bank of Moorabool River, Lethbridge ("C."). Neumerella (F.C.). Dreir's, Mitchell River, lower bed ("C."). Forsyth's, Grange Burn (remanié fragments, "H."). Railway cutting between station and river, Dartmoor ("C."). South Australia—About 15 feet above river level, Murray River Cliffs at Morgan ("C."; holotype, C.). Four miles below Morgan, Murray River, middle bed ("C."). Murray River Cliffs from Wongulla to Mannum, lower beds ("C."). Near Millicent ("C."). Aldinga, lower beds ("C.").

Range.—Upper Oligocene to Miocene.

Goniocidaris pentaspinosa Chapman and Cudmore.

Plate XIV, figs. 18, 19.

Goniocidaris pentaspinosa Chapman and Cudmore, in Chapman, 1928, p. 91.

The following description is amplified and emended from our preliminary description:—Test small, very depressed; ambulacra wavy; interporiferous areas with two vertical rows of small miliaries on inner ends of opposing ambulacral plates; towards ambitus, two other rows of smaller tubercles inclined at 45 degrees downwards from larger tubercle on same plate; surface then sharply descends to a sunken area; this area, containing the suture, is as wide as either poriferous zone and consists of horizontal ridges leading downwards from the tubercles. Poriferous zones sunken; pores non-conjugate, circular, close together, each pair separated from next pair by a ridge. Six ambulacral plates adjacent to largest coronal plate. Coronal plates up to seven in number. Scrobicules sunken and circular, becoming elliptical near actinosome; boss conical, uncrenulated; perforate mamelon contracted at base, small in proportion to boss. Tubercles on coronal plates almost entirely confined to prominent ring, though a few are situated towards median interambulacral area; ring slightly overhangs scrobicule. Scrobicules not confluent, though rings merge in actinal region. Median interambulacral area narrow, continuous, sunken, bare, with pits at angles of coronal plates. Upper abactinal plates separated by grooves at horizontal sutures.

Slender spines found in same strata as tests polygonal in section, bearing usually from five to eight ridges, finely but distinctly serrated. Ornamentation varies from mere punctae to short spinules, the latter invariably arranged in series; towards base spinules more accentuated and salient. Ring milled. Colour bands occasionally preserved.

Observations.—*Goniocidaris pentaspinosa* is a typical member of the genus, and like *G. prunispinosa* has a wide range in

Australian Cainozoic deposits. It is distinguished from all other fossil species by the prominent evenly-composed scrobicular ring which has no miliaries visible to the naked eye outside it. The imperfect test from Wongulla now selected as a neotype is substituted for that specimen from Neumerella (Reg. No. 13754) originally figured, which proves to be *G. murrayensis*.

Measurements.—Neotype: height of test, 10 mm.; width of interamb area, 8 mm.; width of amb plate, 1.75 mm.; width of coronal plate, 4.5 mm.; height, 3.5 mm. Paratypes: length of longest spine, 34 mm.; diameter of shaft at ring, 2 mm.

Localities.—Victoria—Grice's Creek, near Frankston ("C."; paratypes, 5 spines, C.). Balcombe Bay, Mornington (N.M., "C."). Altona Bay Coal Shaft ("F.A.S.," "C."). Sorrento Bore at 1330 ft. (N.M.). Orphanage Hill, Fyansford (N.M., "C."). Murgheboluc, Sections 4A and 2B ("C."). Neumerella (F.C.). Mitchell River (D.; "F.C."). Skinner's, Mitchell River ("C."; spines with colour bands, "C.P.C."). Clifton Bank, Muddy Creek, Hamilton ("F.C.," "C."). Gellibrand ("H.," "C."). Nelson ("H."). South Australia—Wongulla, Murray River, near base of cliffs ("C."; neotype, C.). Morgan, lower beds ("C."). Four miles below Morgan ("C."). Murray River Cliffs, from Wongulla to Mannum, lower beds ("C."). Torrensdale, Holding's Old Quarry, 4 miles N.N.W. from Mt. Gambier ("C.").

Range.—Upper Oligocene to Miocene.

Goniocidaris murrayensis sp. nov.

Plate XIV, figs. 20–22.

Goniocidaris pentaspinosa Chapman and Cudmore (pars), 1928, pl. XI, figs. 74g.

Test small, round, very depressed. Apex wider than actinosome. Ambulacra broad, sinuous; poriferous zones sunken. Pores non-conjugate, circular, close together, separated by thin ridge; ambulacral plates bearing them often not horizontal. On upper part of inner end of each ambulacral plate, a tubercle with well-developed boss; separated from similar tubercle on next plate of same vertical series towards apex by small granule on margin of that plate; a second and smaller tubercle at 45 degrees downwards from the first; opposite these tubercles a third smaller than the second usually present. The third tubercle occupies part of median area of sunken interporiferous zone; the side of this area consequently has a raised zigzag appearance; interporiferous zone equal in width to a poriferous zone. Five ambulacral plates adjacent to largest coronal plate. Six coronal plates. Scrobicules slightly sunken, circular, tending to become elliptical near actinosome; boss large, conical, uncrenulated; mamelon perforate, small in comparison to boss. Scrobicular ring slightly overhangs scrobicule; composed of closely packed tubercles of uniform size; a few tubercles also closely packed outside ring, but (including in count those in ring) they are never more than two deep on plates except towards median area of interambulacra; in this area are two extensions of tubercled surface, three tubercles being in a row, linking each plate to similar extensions from each of the two nearest plates in opposite vertical series; suture faintly visible. Plates nearest apex marked off from adjacent plates below by a deep horizontal sutural groove; elsewhere in the vertical series

the rings meet, but on either side of each junction horizontal sutures are marked by a groove; groove next median interambulacral area leads into deep pit between extensions of ornament already mentioned. Scrobicules not confluent. Median area of interambulacrum narrow.

Specimens larger than holotype have seven coronal plates; in more mature tests tubercles nearest interambulacral median area do not extend across suture except in actinal portion of test; on abactinal portion surface containing suture becomes more prominent as a depressed, bare area linking up pits; marginal surface next median suture is widened and is ornamented with more numerous, crowded tubercles.

Observations.—This well-preserved little test undoubtedly belongs to the genus *Goniocidaris*. It is close to *G. pentaspinosa*, but varies from it in the ladder-like character of the interambulacral median area. The sutural groove separating uppermost coronal plates from plates lying next but one to the apex is a feature of the living *G. tubaria*. The usual number of ambulacral plates adjacent to the largest coronal plate is seven. Spines have not been recognised. The interambulacral zone from Neumerella previously figured (1928, Pl. XI, fig. 74g) as *G. pentaspinosa* is now referred to *G. murrayensis*.

Measurements.—Holotype: diameter of test, 13.25 mm.; height, 6.25 mm.; diameter across apical system, 6.5 mm.; diameter across peristome, 5 mm.; width of amb, 2 mm.; width of interamb, 5 mm.; width of coronal plate at ambitus, 3 mm.; height, 2.5 mm.

Localities.—Victoria—Neumerella (N.M., Reg. No. 13754). Longford ("H."). Flinders ("C."). South Australia—Lower Murray Cliffs (Holotype, complete test, N.M.). Morgan, lower beds ("C."; paratype, N.M.). Wongulla, Murray River, lower beds ("C."). Aldinga, lower beds (S., D., "C.").

Range.—Upper Oligocene to Miocene.

Goniocidaris mortenseni sp. nov.

Plate XIV, figs. 23, 27.

Test rather small. Ambulacra broad, slightly sinuous. Poriferous zones sunken. Pores non-conjugate, oval, close together, separated by thin ridge. Margin of interporiferous zone on each ambulacral plate marked by a single large tubercle, consisting of boss and mamelon, opposite end of ridge which divides pairs of pores from one another; against inner side of tubercle two small granules form a defined edge from which horizontal, broad, rounded ridges slope sharply downwards to median suture. There is therefore a pronounced nearly vertical ridge between poriferous zone and median area of interporiferous zone. Eight ambulacral plates adjacent to largest coronal plate. Number of coronal plates unknown. Scrobicules sunken; elliptical in actinal region, nearly circular elsewhere; not confluent. Perforate mamelon small in comparison to conical, uncrenulated boss. Scrobicular ring does not overhang scrobicule; composed of large tubercles; a few smaller tubercles lie beyond it, particularly in region of interambulacral median area where ornament ends and surface of plate drops vertically to a bare, sunken area. Suture in

middle of this area only slightly zigzag. Horizontal sutures between coronal plates end against poriferous zone in small well-defined pits, but in median interambulacral area they terminate in deep, v-shaped grooves or pits. Halfway between any two of these latter grooves, opposite centre of each plate, is a much smaller depression in sunken median area.

Spines short, probably never as long as horizontal diameter of test. Many retain original purplish colour. Ring milled, collar finely striated. No narrowing of shaft near neck ; it sometimes thickens slightly above neck, then tapers to apex ; tapering often very slight. Spines covered with short thorns, irregularly arranged, inclined a little towards apex. A few spines flattened apically. Apex more or less flared, often cup-shaped ; diameter of cups never exceeds that of thickest part of shaft.

Measurements.—Holotype (test fragment) : vertical length of four coronal plates, 19.5 mm. ; height of largest plate, 5.25 mm. ; width of largest plate, 9.5 mm. ; width of amb plate, 3.5 mm. Paratypes (spines) : length of longest spine, 23 mm. ; diameter of shaft, 2.5 mm.

Observations.—*Goniocidaris mortenseni* is very close to the living *G. tubaria*, but has a less depressed test, fewer tubercles on the portion of the coronal plate next the interambulacral zone, and broader and shorter v-shaped grooves. The interporiferous area as far as the suture, not counting marginal tubercles, is more sunken, and is equal in width to the poriferous zone. The poriferous zone is more sunken, and the longitudinal ridge of tubercles marginal to it is far more pronounced. Only fragments of the test have been found. Spines and test-fragments are from the same stratum and are undoubtedly conspecific. The spines differ from those of living species in being more slender and rarely flattened ; they terminate in tiny cup-shaped flares, whereas the apex in recent spines is shaped like a nearly fully opened hand.

We have named this species after Dr. Th. Mortensen, whose magnificent Monograph on the Cidaroida has proved of the greatest help to us.

Localities.—South Australia—Aldinga, upper beds (holotype, C. ; paratypes, 6 spines from same beds, C ; also "C.")

Range.—Lower Pliocene.

Genus CHONDROCIDARIS A. Agassiz 1863.

Both living species of *Chondrocidaris* are confined to the Indo-Pacific. A possible fossil form of this genus occurs in the (?) Miocene of Madagascar. Some of the spines described as *Phyllacanthus sundaica* Martin from the Miocene of Java probably belong to the same genus. The pores are conjugate (Mortensen, 1928).

Chondrocidaris clarkii sp. nov.

Plate XIII, figs. 15–17 ; Plate XV, fig. 31.

Syntype from Morgan : an almost complete young test, actinal portion of one interamb zone alone missing ; somewhat flattened at apex, depressed abactinally, of medium size. Ambulacra wide, nearly straight ; level interporiferous areas at ambitus with six vertical rows of small miliary tubercles, two of which disappear towards actinosome and probably also towards apex. No trace of median depression, but suture visible. Poriferous zones slightly sunken. Pores conjugate, oval, close together. Ten ambulacral plates adjacent to largest coronal plate. Interambulacra broad. About eight coronal plates ; marginal area adjacent to poriferous zone flat. Boss uncrenulated ; small mamelon, contracted at neck. Scrobicules deeply sunken, not confluent ; elliptical at ambitus and towards actinosome, circular towards apex ; bounded by a ring of tubercles which slightly overhangs margin ; tubercles composing ring widely spaced, the space between any two being entirely bare and not invaded by granules placed beyond ring. Median area of interambulacra broad and flat ; no trace of median depression ; uniformly covered with small, closely packed miliaries. Median suture either invisible or very faint.

Syntype from near Overland Corner : a perfect adult test, large. Abactinal region well shown. Rows of small miliary tubercles in ambulacra similar to those of smaller syntype. Suture a fine line in almost flat median interambulacral area. Entire perignathic girdle visible. Eight coronal plates ; marginal areas adjacent to poriferous zone almost flat. Fourteen ambulacral plates opposite largest coronal plate.

Measurements.—Syntype from Morgan : diameter across peristome, 13 mm.; horizontal diameter of test, 36 mm. ; height of test, about 22 mm. ; width of interamb area at ambitus, 17.5 mm. ; width of amb, 4.25 mm. ; width of coronal plate at ambitus, 9.25 mm. ; height of plate, 5.25 mm. Syntype from below Overland Corner : horizontal diameter, 62 mm. ; height, 33 mm. ; diameter across apical system, about 21.5 mm. ; diameter across peristome, 20.5 mm. ; width of interamb area at ambitus, 30 mm. ; width of amb, 6 mm. ; width of coronal plate at ambitus, 16 mm. ; height of plate, 9 mm.

Spines resembling those of living species of *Chondrocidaris* occur in same strata as tests, and evidently belong to this species. Figured paratypes from an infilled pocket in strata at Morgan evidently came from one individual. Length of longest spine, 50 mm. Long, slender, thorny near base, longitudinally ridged towards apex. Collar finely striated ; lines crossing ring give it a milled appearance. Plane of ring not at right angles to shaft. No narrowing of shaft above collar, and little tapering. Near collar, shaft is circular in section, but it gradually flattens. More flattened side bare of ornament near collar ; for more than half length of shaft bears broad, thin thorns, outwardly directed, becoming wing-like along sides of shaft ; these thorns give place to thin ridges capped with outwardly directed points. Ridges end at blunted spinal apex. A smaller spine (30 mm.) has no ridges, but ends in winged apex with serrated edges : an identical spine was collected at Brown's Creek, Cape Otway district. Another spine (16.5 mm.) bears only fine serrated ridges which increase in height towards blunt apex. All retain traces of original purple colour.

Observations.—The principal features distinguishing the above species are the typically flattened and closely granulated plates

of the interambulacral median area ; the conjugate pores and the characteristic spines.

We have much pleasure in naming this species after Dr. H. Lyman Clark who assisted us both by his personal advice and publications.

Localities.—Victoria—Brown's Creek, Cape Otway district ("H."). South Australia—Morgan, Murray River Cliffs, about 12 feet above river level ("C." ; syntype, and paratypes—6 spines, all C.). Murray River, lower beds, eighth cliff below Overland Corner, left bank (syntype, C.). Overland Corner, Murray River, lower beds (C.). Wongulla district, Murray River, lower beds ("C.").

Range.—Upper Oligocene to Miocene.

Club-shaped Spines, *incertae sedis.*

Plate XIV, figs. 25, 26*a*, *b*.

We have failed to correlate certain cidaroid spines with any of the above species.

Short club-shaped spines with slightly expanded tips and ornamented with linearly arranged granules are rare except at Booanya, Western Australia, where 985 specimens were collected and presented to the National Museum by Miss A. E. Baesjou. Mortensen (1928, fig. 46) figures tests of *Prionocidaris* and *Stereocidaris* exhibiting spines which tend to become club-shaped, but evidence concerning the spines here considered does not justify correlation with species of those genera described by us, of which only *Phyllacanthus duncani* occurs at Booanya. Two long spines, bearing some resemblance to the small club-shaped spines in ornamentation have been collected with them at Waurn Ponds ("H") and near the Glenelg River ("C.P.C."). The great abundance of clubs at Booanya and the absence of identically ornamented slender spines from the collection made there suggest genera which bore club-shaped spines only, as for example in *Eucidaris*, a genus now living in Northern Australia. We hope to elucidate this problem by comparing sections of these fossil spines with other Australian forms and by additional field evidence.

Localities.—Victoria—Waurn Ponds, Geelong (C. ; "C."). Near Glenelg River, Parish of Wataepoolan ("C.P.C."). Point Addis ("C."). South Australia—Mt. Gambier ("C."). Western Australia—Booanya, near Balladonia (N.M.).

Range.—Miocene.

Smooth Spines, *incertae sedis.*

Plate XIV, fig. 24.

The spines are typically smooth and colour-banded ; towards the apex some have several very faint lines of prickles and more

rarely a spinule (0.5 mm. in length). The longest spine bears seven dull purplish-brown colour-bands (1 mm. wide) encircling the shaft at intervals of 2 mm. ; on one side of the shaft the colour is less pronounced. The shaft is slender, circular in section and tapering ; it bears fine striae which cross the ring.

Although there is a suggestion of affinity with *Goniocidaris prunispinosa*, we are unable to determine to which species these spines belong.

Measurements.—Longest spine, apex missing, Wongulla, Murray River, lower beds : length, 27 mm. ; average length about 21 mm.

Localities.—South Australia—Morgan, lower beds, and from Wongulla to Mannum, River Murray, lower beds. Aldinga, lower beds. Figured spines in (C.) ; all others in ("C.").

Range.—Upper Oligocene to Miocene.

Synopsis of Material.

In order to indicate relative abundance of different species we have made an approximate count of specimens examined by us. The amount of collected material is partly governed, of course, by the accessibility of the richer localities to collectors.

	Tests	Fragments	Spines
Stereocidaris australiae	3	99	534
Phyllacanthus duncani	—	174	615
Prionocidaris scoparia	1	22	114
Goniocidaris prunispinosa	1	26	468
G. pentaspinosa	—	10	115
G. murrayensis	1	22	—
G. mortenseni	—	26	160
Chondrocidaris clarkii	2	5	30
Smooth spines, *incertae sedis*	—	—	60
Club-shaped spines, *incertae sedis* ..	—	—	985

Key to Abbreviations of Names of Collections.

Collections in the National Museum :—

N.M.=National Museum general collection. D.=Dennant Coll. S.=Sweet Coll. M.=Mulder Coll. W.=Wilkinson Coll. (Geol. Surv. Vict.). C.=Cudmore Coll. F.C.=Chapman Coll. H.=Hall Coll.

Other collections (all distinguished by inverted commas) :—

"C."=Cudmore Coll. "C.P.C."=Commonwealth Palaeontological Coll. "F.C."=Chapman Coll. "F.A.S."=Singleton Coll.. "G.C."=Rev. G. Cox Coll. "H."=Hall Coll. (the part in Cudmore Coll.).

Synopsis of Species.

St. australiae	Ph. duncani	Pr. scoparia	Ch. clarkii
Test small to medium. Abactinally depressed, actinally greatly depressed.	Medium to large. Slightly abactinally depressed.	Large. Slightly abactinally depressed.	Rather small to large. Somewhat depressed.
Non-conjugate pores.	Conjugate.	Conjugate.	Conjugate.
12 ambulacral plates adjacent to largest coronal plate in adult specimens.	17 Plates.	15 Plates.	10 Plates.
Ambulacra narrow, slightly wavy; 4, 6, or 8 vertical rows of miliaries in interporiferous areas.	Undulating, narrow; 4, 6, or 8 rows of miliaries.	Undulating, narrow; 4, sometimes 6, rows of miliaries.	Broad, nearly straight; 6 rows of miliaries.
Scrobicules deeply sunken (variable); slightly elliptical below ambitus, otherwise circular.	Sunken, elliptical, becoming circular.	Shallow, elliptical at ambitus, circular near apex.	Sunken, elliptical, circular near apex.
Scrobicular ring overhangs; inconspicuous.	Not overhung; ring conspicuous.	Not overhung; ring conspicuous.	Slightly overhangs; ring conspicuous.
Interambulacral median area broad (narrow in young specimens); sunken.	Broad; only slightly depressed at suture.	Very narrow; only slightly depressed at suture.	Broad, flat.
Pits and grooves at horizontal sutures between coronal plates.	No pits or grooves.	No pits or grooves.	No pits or grooves.
Perforate mamelons usually absent from abactinal coronal plates; 1–5 in each iamb series.	Never more than one rudimentary non-perforate mamelon in each iamb zone.	Ditto.	Ditto.

G. prunispinosa	G. pentaspinosa	G. murrayensis	G. mortenseni
Rather small. Depressed.	Small. Very depressed.	Small. Very depressed.	Rather small. Shape unknown.
Non-conjugate pores.	Non-conjugate.	Non-conjugate.	Non-conjugate.
6 ambulacral plates adjacent to largest coronal plate in adult specimens.	6 Plates.	5 Plates.	8 Plates.
Suture in interporiferous area very slightly sunken.	Sunken.	Sunken.	Sunken.
Scrobicules sunken, elliptical, circular near apex.	Sunken, circular, elliptical near actinosome.	Slightly sunken, circular, elliptical near actinosome.	Sunken, elliptical in actinal region, nearly circular elsewhere.
No ring of tubercles around scrobicules. Margin overhangs latter. Tubercles on non-scrobicular portion of plate not numerous.	Conspicuous scrobicular ring overhangs slightly. Tubercles on plate almost entirely confined to ring.	Conspicuous scrobicular ring overhangs slightly. Tubercles outside ring crowded.	Conspicuous ring does not overhang. Few tubercles outside ring.
Interambulacral median area broad, tuberculate, not sunken. No pits at angles of plates.	Narrow, sunken, bare. Pits present.	Median area is crossed by raised ornament connecting adjacent plates; pits in between.	Bare, sunken. Pits present.
No horizontal sutural groove between two uppermost abactinal iamb plates.	Sutural groove present.	Sutural groove present.	Unknown.

ACKNOWLEDGMENTS.

We desire to tender our sincere thanks for the loan of specimens to C. T. Madigan, M.A., F. A. Singleton, M.Sc., and the Rev. George Cox; we have also to thank Miss A. E. Baesjou for presenting a fine series of cidaroid spines from Booanya, Western Australia.

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Explanation of Plates.

Plate XII.

Fig. 1. *Stereocidaris australiae* (Duncan). Actinal view of plesiotype ; Aldinga, lower beds. Tate Coll. Nat. size.

Fig. 2. *S. australiae.* Abactinal view of same specimen, showing apical system. Nat. size.

Fig. 3. *S. australiae.* Large iamb zone ; Aldinga, lower beds ; Plesiotype ; Tate Coll. Nat. size.

Fig. 4. *S. australiae.* Iamb zone with nine perforate mamelons in an iamb row ; Aldinga, lower beds ; Plesiotype (Reg. No. 13698) ; Nat. Mus., Dennant Coll. Nat. size.

Fig. 5. *S. australiae.* Abactinal portion of iamb zone ; Castle Cove ; Plesiotype (Reg. No. 13697). Nat. Mus., coll. T. S. Hall, pres. F.A.C. Nat. size.

Fig. 6*a*, *b*. *S. australiae.* *a*, actinal portion of iamb zone. Plesiotype (Reg. No. 13725) ; Nat. Mus., pres. F.A.C. *b*, iamb zone ; Plesiotype (Reg. No. 13701) ; Nat. Mus., coll. T. S. Hall, pres. F.A.C. Both from Castle Cove. Nat. size.

Fig. 7. *Phyllacanthus duncani*, sp. nov. Iamb zone; Batesford; Holotype (Reg. No. 13707); Nat. Mus., Mulder Coll. Nat. size.

Fig. 8. *P. duncani*, sp. nov. Abactinal portion of iamb zone; Batesford; Paratype (Reg. No. 13706); Nat. Mus., coll. T. S. Hall, pres. F.A.C. Nat. size.

Fig. 9. *P. duncani*, sp. nov. Large iamb zone; Port Macdonnell; Paratype (Reg. No. 13705); Nat. Mus., T. S. Hall Coll. Nat. size.

Fig. 10. *Prionocidaris scoparia*, sp. nov. Abactinal view of test, showing spine; Aldinga, lower beds; Syntype; Tate Coll. Nat. size.

Fig. 11. *P. scoparia*, sp. nov. Iamb zone; Knight's Railway Siding Quarry, near Mount Gambier; Syntype (Reg. No. 13709); Nat. Mus., pres. by the Mines Dept. of Victoria. Nat. size.

Plate XIII.

Fig. 12. *Goniocidaris prunispinosa* Chapman and Cudmore. Spines; Balcombe Bay; 16 Paratypes (Reg. No. 13715); Nat. Mus., pres. F.A.C. x 2.

Fig. 13. *G. prunispinosa*. Spine with cup-shaped apex; Balcombe Bay. Paratype (Reg. No. 13714); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 14. *G. prunispinosa*. Ambital view of test, showing attached spines. Murray River Cliffs, Morgan, lower beds; Holotype (Reg. No. 13174); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 15. *Chondrocidaris clarkii*, sp. nov. Ambital view of test; Murray River Cliffs, Morgan, lower beds; Syntype (Reg. No. 13175); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 16. *C. clarkii*, sp. nov. Ambital view of the other syntype; Murray River Cliffs below Overland Corner, lower beds; Reg. No. 13159; Nat. Mus., pres. F.A.C. Nat. size.

Fig. 17. *C. clarkii*, sp. nov. Abactinal view of the same test, showing part of the perignathic girdle. Nat. size.

Plate XIV.

Fig. 18. *Goniocidaris pentaspinosa* Chapman and Cudmore. Iamb zone. Wongulla, Murray River, lower beds; Neotype (Reg. No. 13717); Nat. Mus., pres. F.A.C. ×2.

Fig. 19. *G. pentaspinosa*. Spines; Grice's Creek; 5 Paratypes (Reg. No. 13718); Nat. Mus., pres. F.A.C. ×2.

Fig. 20. *G. murrayensis*, sp. nov. Iamb zone; Morgan, lower beds; Paratype (Reg. No. 13719); Nat. Mus., pres. A. King. ×2.

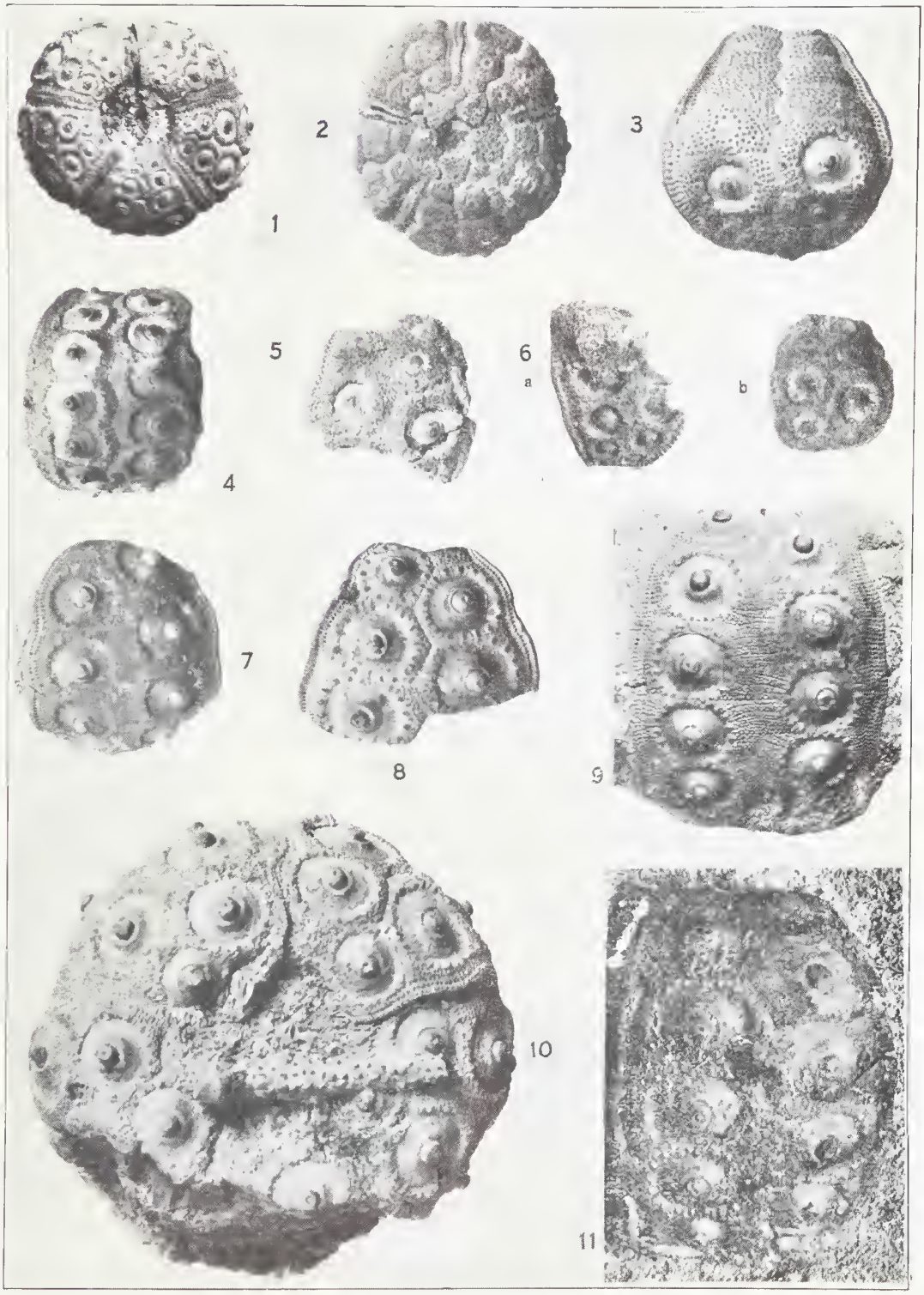
Fig. 21. *G. murrayensis*, sp. nov. Actinal view of Holotype; Lower Murray River Cliffs; Reg. No. 4674; Nat. Mus., coll. C. R. Thatcher. ×2.

Fig. 22. *G. murrayensis*, sp. nov. Ambital view of holotype. ×2.

Fig. 23. *G. mortenseni*, sp. nov. Test fragment; Aldinga, upper beds; Holotype (Reg. No. 13720); Nat. Mus., pres. F.A.C. ×2.

Fig. 24. 3 Smooth Spines, *incertae sedis*, showing colour bands; Wongulla, Murray River, lower beds; Reg. No. 13722; Nat. Mus., pres. F.A.C. ×2.

Fig. 25. 3 Club-shaped Spines, *incertae sedis*; Booanya, Western Australia; Reg. No. 13723; Nat. Mus., pres. Miss A. E. Baesjou. ×2.



Cainozoic Cidaroids

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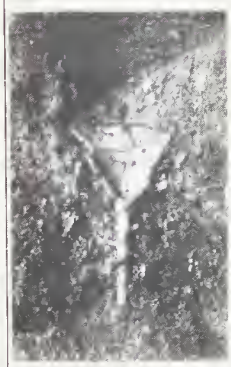

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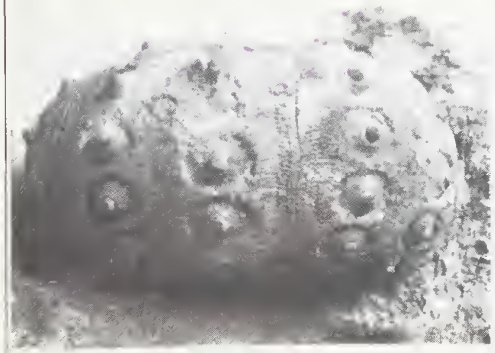

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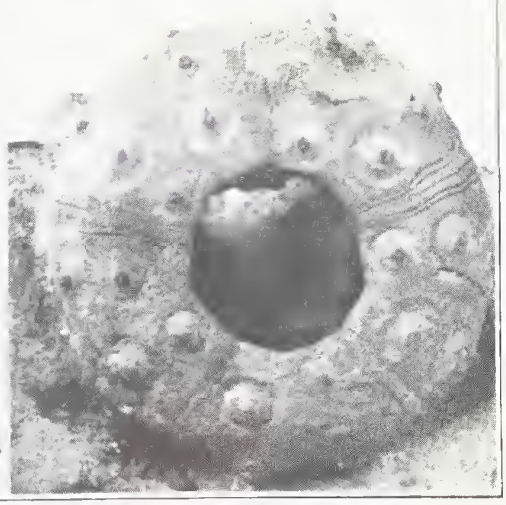

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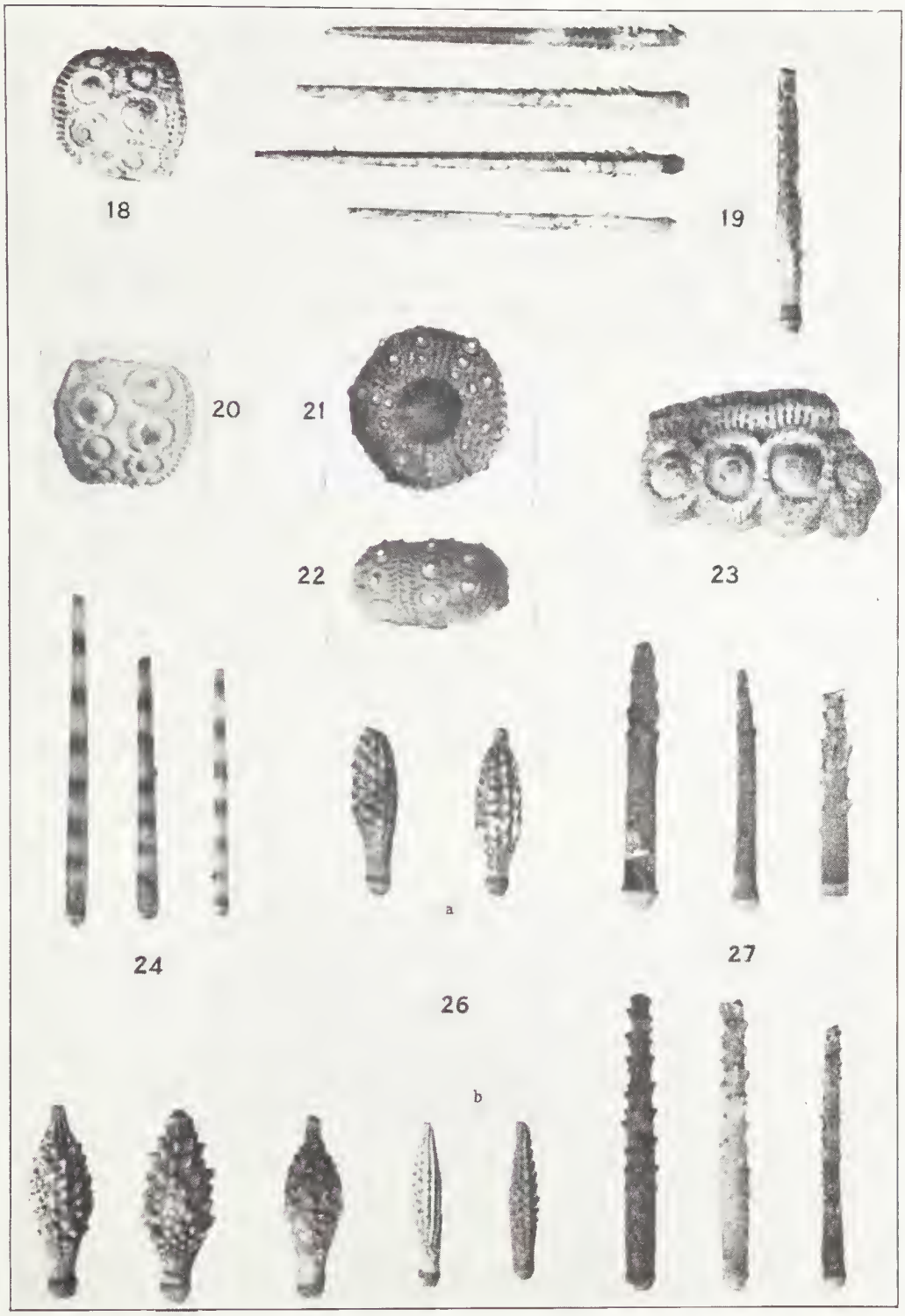
Cainozoic Cidaroids



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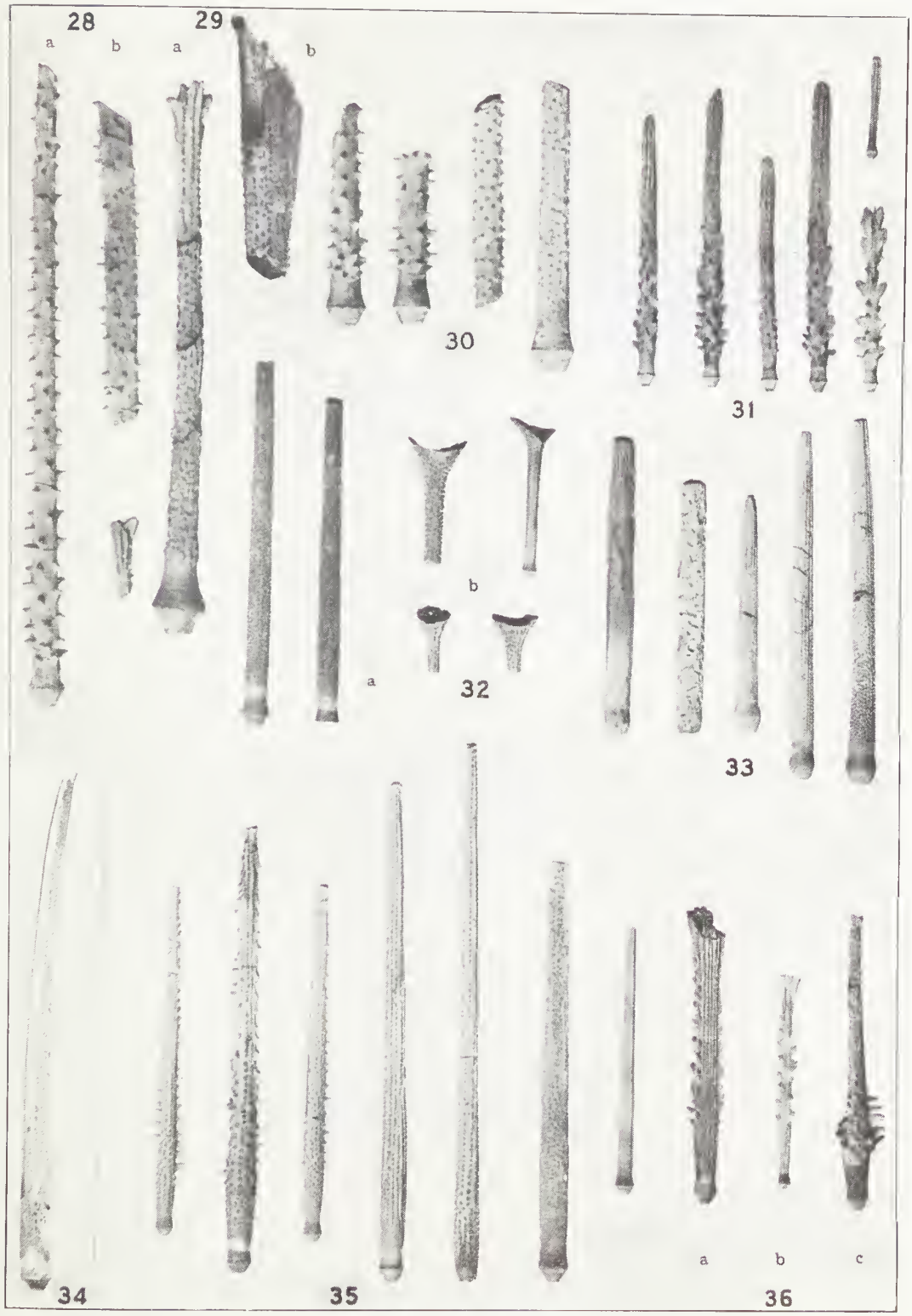


Cainozoic Cidaroids

Fig. 26*a*, b. 4 Club-shaped Spines, *incertae sedis;* Waurn Ponds; Reg. No. 13724; Nat. Mus., pres. F.A.C. ×2.

Fig. 27. *Goniocidaris mortenseni*, sp. nov. Spines; Aldinga, upper beds; 6 Paratypes (Reg. No. 13721); Nat. Mus., pres. F.A.C. ×2.

Plate XV.

Fig. 28*a–c*. *Prionocidaris scoparia*, sp. nov. *a*, thorn-bearing spine, tip imperfect; *b*, thorn-bearing spine with flattened shaft; *c*, a spine tip. All from Aldinga, lower beds; 3 Paratypes (Reg. No. 13710); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 29*a*, *b*. *P. scoparia*, sp. nov. *a*, complete spine with shorter thorns, showing tip; Reg. No. 13711; Nat. Mus., pres. F.A.C. *b*, fragmentary flattened spine with similar ornament, showing tip; Tate Coll.; Paratypes. Both from Aldinga, lower beds. Nat. size.

Fig. 30. *P. scoparia*, sp. nov. Fragmentary spines to show ornament; Aldinga, lower beds; 4 Paratypes (Reg. No. 13712); Nat. Mus., Sweet Coll. Nat. size.

Fig. 31. *Chondrocidaris clarkii*, sp. nov. Spines; Morgan, lower beds; 6 Paratypes (Reg. No. 13713); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 32*a*, *b*. *Stereocidaris australiae* (Duncan). *a*, Spines, tips missing; 2 Plesiotypes (Reg. No. 13699). *b*, cup-shaped spine tips; 4 Plesiotypes (Reg. No. 13700). All from Point Flinders, near Cape Otway; Nat. Mus., pres. F.A.C. Nat. size.

Fig. 33. *Phyllacanthus duncani*, sp. nov. Spines, two showing peeling of outer ornament; Batesford; 5 Paratypes (Reg. No. 13708); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 34. *Stereocidaris australiae*. Curved spine; Aldinga, lower beds; Plesiotype; Tate Coll. Nat. size.

Fig. 35. *S. australiae*. Spines, one showing colour bands; Aldinga, lower beds; 7 Plesiotypes (Reg. No. 13702); Nat. Mus., pres. F.A.C. Nat. size.

Fig. 36*a–c*. *S. australiae*. *a* and *b*, spines; 2 Plesiotypes (Reg. No. 13703). *c*, spine, with wing-like projections near the neck; Plesiotype (Reg. No. 13704). All from Aldinga, lower beds; Nat. Mus., pres. F.A.C. Nat. size.

NOTES ON A RARE LORICATE, *RHYSSOPLAX EXCELLENS* Iredale and Hull.

By John S. Mackay, M.D., Hon. Conchologist (Loricates), National Museum, Melbourne.

Plate XVI.

Family **CHITONIDAE** Pilsbry 1892.

Genus RHYSSOPLAX Thiele 1893.

Rhyssoplax excellens Iredale and Hull.

1877. *Chiton pulcherrimus* Sowerby. Brazier, Proc. Linn. Soc. N.S.W., ii, 1877, 75. Darnley Island, Torres Strait. Type in Macleay Museum, Sydney. Not *C. pulcherrimus* Sowerby, P.Z.S., 1841, 103, from Island of Bohol, Philippine Group, in Mus. Cuming.

1926. *Rhyssoplax excellens* Iredale and Hull, Aust. Zool., iv, 1926, 181, pl. xix, f. 22, 27, 40. Darnley Island, Torres Strait. Type in Macleay Museum, Sydney.

1928. *Chiton (Rhyssoplax) excellens capricornensis* Ashby, Trans. Roy. Soc. S. Aust., vol. 53, 1928, p. 169, pl. 12, f. 1, 13. Capricorn Reef, Queensland. Type in coll. Ashby.

Historical note.—Early in 1875 the Chevert Expedition under the direction of Sir William Macleay left for North Queensland and New Guinea. They called at various points of the two mainlands and visited numerous islands off the Queensland coast and in Torres Strait. After an absence of five months they returned with extensive zoological and botanical collections. Among the islands visited was Darnley Island off the coast of New Guinea and here was taken a solitary example of a Loricate believed to be *Chiton pulcherrimus* Sowerby, a Philippine shell. It was so named by J. Brazier at a meeting of the newly formed Linnean Society of New South Wales of which Sir William Macleay was the first President.

Nearly fifty years later the Darnley Island shell was sent to Iredale at the British Museum for comparison with the type of *C. pulcherrimus* Sowerby. It was found to differ in certain details and in 1926 Iredale and Hull published it in their Monograph of the Australian Loricates as *Rhyssoplax excellens* (supra).

As only one shell 22 mm. in length was available and as details of exact locality, station, habits, etc., were unknown, the description was necessarily incomplete.

In 1928 Edwin Ashby published a short account of a shell received from the Capricorn Reef, where it had been collected by W. J. Kimber. Ashby recognised the close relationship of this specimen to the rare *R. excellens*, but, believing the Capricorn shell to differ subspecifically, he published it as *Chiton* (*Rhyssoplax*) *excellens capricornensis* (supra).

Until recently these two specimens from widely divergent localities nearly 800 miles apart were the only ones known.

In August 1931 the present writer took advantage of the exceptionally low new moon tide to examine the littoral on the south side of Magnetic Island, North Queensland. Close to the jetty at Nellie Bay are some piles of granite fragments, evidently debris from the road which has here been blasted from the solid rock. The granite is fine-grained and tends to fracture with a smooth surface. The fragments of rock lay in piles extending below the lowest tide level and had become somewhat cemented together at the edges by coralline debris. Over an area of about nine feet square a colony of nine individuals of *Rhyssoplax excellens* was found.

This fine series permits some expansion of the original description.

General Appearance.—Elongate ovals of medium size, strongly elevated, carinate, of complex sculpture.

Colour.—Variable.

1. Type. Darnley Island. "Creamy brown, the girdle with darker banding."

2. Ashby's specimen from Capricorn Reef. "Creamy white, with bright red blotches on six of the valves."

3. Magnetic Island specimens. *a.* Creamy brown, jugal areas touched with darker brown; girdle banded cream and brown. *b.* Cream, umbones of valves 2, 4, 5 and 6 and lateral portions of pleural areas of valves 2 to 8 maroon; girdle banded cream and reddish brown. *c.* Yellow, umbones and lateral areas tinted green; girdle banded yellow and green.

Anterior Valve.—Strongly erect, conspicuous from other valves. Sculpture consists of 20 to 25 radiating strongly nodulose ridges in adult shells; juveniles show a smaller number of ridges, but in between may be seen all stages from a single nodule up to the fully developed ridge. Apical tip smooth and polished. Posterior margins show from 11 to 20 serrations on each side; this feature, which is beautifully shown in young specimens, may, from erosion, be less apparent in adults.

Median Valves.—Second valve larger than the others. Lateral areas strongly elevated with usually three (rarely four) bold, nodulose ribs; when four ribs occur, it is usually on the second valve. Juveniles may show two strong ribs and a weak one between. Posterior margins strongly toothed as in the anterior valve. Pleural areas crossed by 12 to 16 strong longitudinal ridges with deep interstices at lateral margins; they become shallow and

irregular towards the jugal area which is narrow, smooth and beaked. Interstices between longitudinal ridges are further divided by laterals producing a complex gridiron pattern ; bottoms of pits thus produced are finely granular. In older shells erosion and the invasion of parasitic growths tend to obscure the finer details of sculpture.

Posterior Valve.—Mucro median, sharply angulated ; a well defined transverse ridge traverses the mucro and separates the antemucronal and postmucronal areas. Postmucronal area concave, sculptured with 15 to 20 radiating, boldly nodulose ribs. Jugal portion of antemucronal area narrow, smooth ; lateral portion sculptured in same manner as pleural area of median valves.

Girdle.—Of medium width ; composed of oval scales which, in common with those of many Lorieates, are larger in the area midway between valves and girdle margins. Scales marked with about eight deep regular grooves which terminate, leaving apex smooth, rounded and polished.

Interior Colour.—Tail valve green. Remainder green to greenish-yellow or white.

Slitting.—Head valve, 8 to 10 slits : median valves, single slit each side : tail valve, 11 to 14 slits. The usual formula for the genus is 8—1—10 or more. Two of the Magnetic Island shells showed ten slits in the head valve ; three had nine slits. Of the series of nine, four only complied with the usual formula and one of these four is in doubt. Appearances indicate that the normal eight-slit pattern is present, with the additional slits and slit-rays interposed.

Sutural Laminae.—Rather small, semilunar, widely separated by a deep sinus at bottom of which may be seen a narrow coarsely serrated bridge of articulamentum uniting sutural laminae.

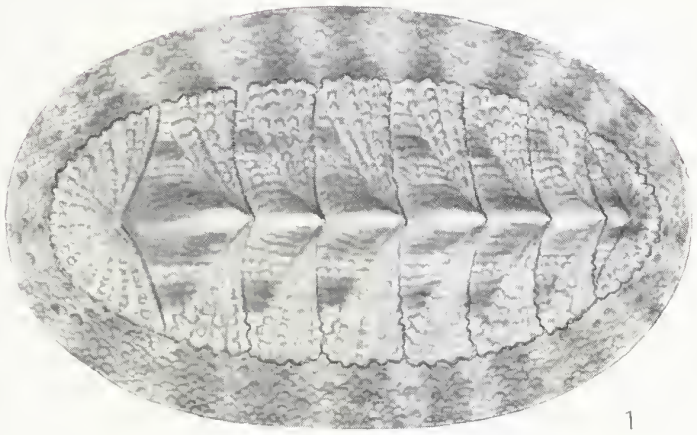
Dimensions.—28 x 19 mm. (max.). Others 27, 26, 25, 21, 17, and 15 mm. in length.

Station.—On sides and under surface (rarely upper surface) of fairly large stones cemented together by edges and corners below usual tide level, but wholly emergent at lowest spring tides (e.g.—4 tide).

Range.—North Queensland Coast from Torres Strait to Caprieorn Reef.

Remarks.—They appear to be sedentary in habit and solitary in disposition. They were found singly, and when exposed did not move about. Adult shells were encrusted with calcareous and spongy growths and in two instances the tegmentum was pierced by a boring parasite without killing the host. The extraneous matter together with a fine coating of mud made them inconspicuous. Shells from the cleaner waters of Torres Strait or the Capricorn Reef would be less likely to be attacked by parasites.

One specimen, 17 mm. in length, which showed the sculpture particularly well was sent to the Australian Museum for figuring and comparison with the type shell from Darnley Island. Iredale, who made the comparison, considers that they are undoubtedly the same species.



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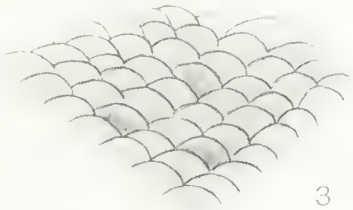

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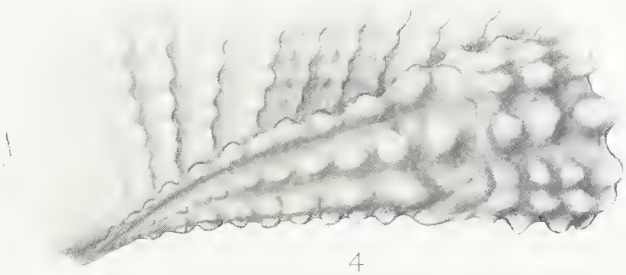

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Rhyssoplax excellens Iredale and Hull

Acknowledgments.—The writer here expresses his obligation to Mr. Tom Iredale, Conchologist, Australian Museum, for a most helpful criticism of manuscript and for comparisons of a Magnetic Island shell with the type from Darnley Island. He is also indebted to Miss Joyce K. Allan, of the Australian Museum, for three beautiful figures.

Plate XVI.

Rhyssoplax excellens Iredale and Hull.

Fig. 1. Whole shell seen from above. ×5 approx.

Fig. 2. Whole shell, side view. ×5 approx.

Fig. 3. Girdle scales. ×17 approx.

Fig. 4. Half median valve. ×24 approx.

(Figs. 1, 3 and 4 by Miss Joyce K. Allan ; fig. 2 by the writer.)

All figures were drawn from shell No. 3161 in the writer's collection, which is in the care of the National Museum.

THE GIRDLE SCALES OF *ISCHNOCHITON* (*CHARTOPLAX*) *PURA* Sykes.

By John S. Mackay, M.D., Hon. Conchologist (Loricates).

Plate XVII.

Family **ISCHNOCHITONIDAE** Dall 1889.

Genus ISCHNOCHITON Gray 1847.

Subgenus Chartoplax Iredale and Hull 1924.

Ischnochiton (*Chartoplax*) *pura* Sykes.

1896. *Ischnochiton* (*Haploplax*) *pura* Sykes, Proc. Mal. Soc., ii, 1896, 88, pl. vi, fig. 3, 3a.

1924. *Haploplax* (*Chartoplax*) *pura* (Sykes). Iredale and Hull, Aust. Zool., iii, 1924, 295.

Ischnochiton (*Chartoplax*) *pura* is a rare shell. Nine specimens are known to the writer. Of these, three are in the Bracebridge Wilson Collection, National Museum, Melbourne; they include the type and two paratypes. There is one specimen in the collection of Mr. J. H. Gatliff. Mr. C. J. Gabriel had two specimens, one of which he generously gave to the writer. Mr. Edwin Ashby has two examples which he courteously sent to the writer for examination. These eight specimens were dredged from approximately the same locality in 6–10 fathoms near Portsea, Port Phillip, Victoria. Mr. A. F. Basset Hull has one specimen dredged in 12 fathoms at Disaster Bay, N.S.W. He very kindly forwarded it for examination and comparison.

Sykes described the shell in 1896 (supra). The general features were those of genus *Ischnochiton*, but, as the shell was almost lacking in sculpture and the girdle scales appeared to be "very small and smooth," Sykes thought it might be included in the subgenus *Haploplax*.

Iredale and Hull, basing their description on Hull's specimen from Disaster Bay, wrote "Girdle wide, scales small, elongate, smooth, flattened, closely imbricating" (Monograph of the Aust. Loricates, p. 40). They left it in genus *Haploplax* on account of its smooth shell and extreme rarity, but suggested the subgeneric name of *Chartoplax*, "the smooth scales being in form quite unlike those of any other member of the genus."

The writer examining the type found that there had been some inaccuracy in the description of the girdle scales. They are very small, the length and breadth being about 36μ*, with extremes varying from 30 to 40μ. They are rounded or slightly elongate, a little uneven in size, and moderately closely set. They are not smooth, but are striated, the striations being fine, even, numerous (20 to 30), and beautifully engraved (Fig. 1). An occasional pointed form is met. Two such occur in that portion of the girdle from which the figure was drawn. Although they imbricate, they do not show that close regular pattern which is found in most members of genus *Ischnochiton*.

The peculiar shape and delicate striation, both so unlike any other *Ischnochiton*, offer some justification for the subgenus *Chartoplax* proposed by Iredale and Hull.

Although it is possible to raise technical objection to the separation of genus *Haploplax* from genus *Ischnochiton*, there can be no question that members of the former genus constitute a well defined sectional group. Six Australian species have been described, *H. smaragdina* Angas, *H. resplendens* Bednall and Matthews, *H. lentiginosa* Sowerby, *H. adelaidensis* Reeve, *H. thomasi* Bednall, and *H. arbutum* Reeve. All may be recognized "at sight" as belonging to *Haploplax*. They are all broadly elliptic in shape, being proportionately wider than *Ischnochiton* generally. They are all of medium size, rarely exceeding 25 mm. in length, and being, as a rule, much smaller. The sculpture is weak, the surface often glossy, and the colouration usually striking and characteristic of the species. The girdle scales are proportionately large and glisten like polished gems. Moreover all the members have a preference for a fairly high station in the littoral zone.

Ischnochiton (*Chartoplax*) *pura* has nothing in common with any of these characteristics except lack of sculpture. For the purpose of comparison, specimens of *Ischnochiton crispus* Reeve and *Haploplax smaragdina* Angas equal in length to the specimen of *I.* (*C.*) *pura* were examined and portions of the girdle were figured on the same scale as that of *I.* (*C.*) *pura* (Figs. 1, 2, 3). It was found that scales of *I.* (*C.*) *pura* measured about 36 x 36μ, those of *I. crispus* about 160 x 60μ, and those of *H. smaragdina* about 218 x 218μ. The scales of *I.* (*C.*) *pura* were thus less than a quarter the size of *I. crispus* and about one-sixth of *H. smaragdina*.

Its station indicates that *I.* (*C.*) *pura* is a deep water *Ischnochiton*. It may be remarked that the insertion plates and

*μ=1/1000 mm.

slitting are somewhat weak. On account of the peculiar scales the subgeneric name of *Chartoplax* becomes appropriate.

Figs. 1, 2, and 3 were all drawn to the same scale of magnification from shells 17 mm. in length. In each case a group of scales in the mid zone between valve and girdle margin was selected.

In fairness to Iredale and Hull, the writer notes that the Disaster Bay shell, although small in size, shows evidence of old age. The girdle scales are somewhat rubbed and the fine striation obscured, although it is undoubtedly present.

Plate XVII.

Fig. 1. *Ischnochiton* (*Chartoplax*) *pura* Sykes, topotype, dredged by Gatliff and Gabriel in 6 to 10 fathoms off Portsea, Port Phillip, Victoria. Girdle scales ×220.

Fig. 2. *Ischnochiton crispus* Reeve, Narooma, N.S.W. Girdle scales ×220.

Fig. 3. *Haploplax smaragdina* Angas, Narooma, N.S.W. Girdle scales ×220.

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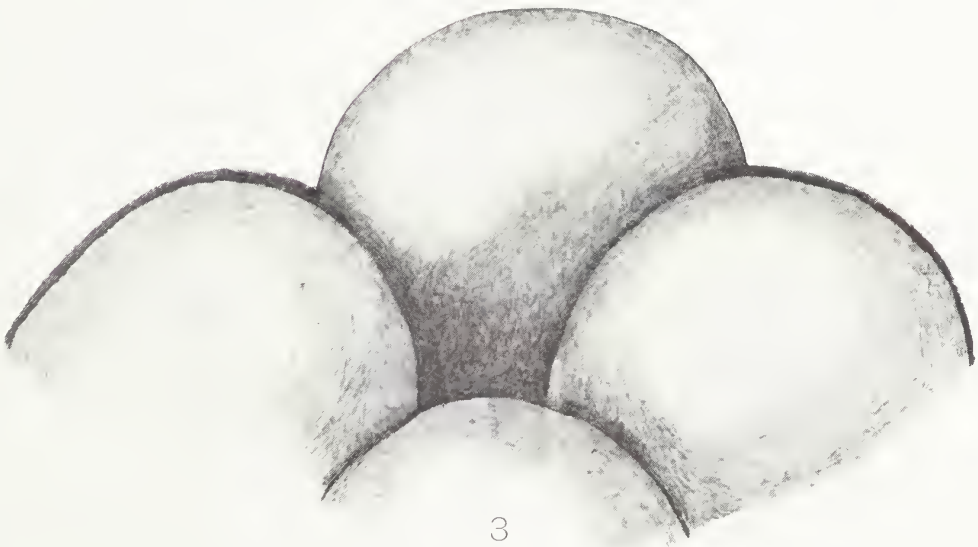

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Girdle scales of (1) *Ischnochiton* (*Chartoplax*) *pura* Sykes, (2) *I. crispus* Reeve, and (3) *Haploplax smaragdina* Angas

THALASSOHELIX TRANSLUCENS, A NEW VICTORIAN LAND SHELL.

By C. J. Gabriel, Hon. Conchologist.

Plate XVIII, figs. 1–3.

The new land shell described below was presented to the National Museum by Mr. J. A. Kershaw together with three other species collected at the same time at Wilson's Promontory : *Chloritis victoriae* (Cox), *Helicarion cuvieri* Ferussac and *Rhytida lamproides* (Cox). Wilson's Promontory is the only Victorian locality from which the last named species has been recorded.

Family **ENDODONTIDAE** Pilsbry.

Genus THALASSOHELIX Pilsbry 1892.

Thalassohelix translucens, sp. nov.

Shell depressed, striated, thin, translucent, barely perforate. Spire rather elevated, convexly conoidal. Whorls including protoconch about four and a half, regularly increasing, flatly convex, with last whorl acutely angled at periphery. Sutures deeply impressed. Aperture oblique, rotundly lunate. Peristome thin, sharp. Columella short, oblique. Inner lip reflected above, almost concealing the narrow and deep perforation, forming a thin callus. Protoconch faintly radiately striate and shows indistinct microscopic spiral lines ; sculpture of succeeding whorls consists of fine, oblique, irregular growth lines and microscopic spiral striae. Colour pale horny, with numerous faint zigzag brown bands of variable pattern which fade at base.

Measurement.—Holotype (Reg. No. R14096) :—major diameter, 14.5 mm. ; minor diameter, 12 mm. Paratype (Reg. No. R14097) :—major diameter, 18 mm. ; minor diameter, 15.5 mm.

Locality.—Lilly Pilly Gully, National Park, Wilson's Promontory, under logs.

Observations.—The genus has hitherto been represented in Victoria by *T. fordei* (Braz.) var. *m'coyi* (Petterd) from which the new species may be distinguished by its more angled periphery and by its zigzag colour bands ; the latter are more distinct in the paratype than they are in the holotype.

Plate XVIII.

Figs. 1, 2 and 3. *Thalassohelix translucens* sp. nov. ; holotype. Twice natural size.

A NEW SPECIES OF MOUSE, *PSEUDOMYS* (*GYOMYS*), AND A RECORD OF THE BROAD-TOOTHED RAT, *MASTACOMYS*, FROM VICTORIA.

By C. W. Brazenor, National Museum of Victoria.

Plate XVIII, figs. a–e.

Family **MURIDAE** Gray 1821.

Subfamily **Murinae** Baird 1857.

Genus PSEUDOMYS Gray 1832.

Subgenus Gyomys Thomas 1910.

Pseudomys (*Gyomys*) *fumeus* sp. n.

A blue-grey mouse allied to the *albocinereus* group, but larger and slightly darker than other species. Dorsal fur long (15 mm.), soft, fine; slate-grey for four-fifths of its length, tipped with mouse grey (Ridg.). Long hairs (20 mm.) numerous, black, imparting a cool tone to the whole. Sides of body lighter, with fewer long hairs. Ventral surface greyish-white; fur slaty for three-fifths of its length, tipped with soiled white, the grey showing through. Line of demarcation not sharp. Head colouration as body but lighter on cheeks and muzzle; upper lip greyish white; a few dark hairs around eye. Ears long; purplish-grey in freshly killed animal; sparsely clothed with white and grey adpressed hairs. Mysticial vibrissae with longer hairs (39 mm.) bicoloured, base black, tips white; shorter hairs white. Manus and pes white; well clothed with silvery-white adpressed hair which forms a fringe around nails. Tail longer than head and body; greyish-brown above, white on sides and below; well clothed with hair 3–4 scales in length which, nevertheless, does not completely hide scales.

Skull.—Smooth, rounded, typical of genus. Muzzle long, narrow; nasals slightly tapering, but articulation with frontal at least 2 mm. in extent. Zygomata diverging posteriorly, straight when viewed from above. Anterior edge of zygomatic plate sloping forward to its base; very slightly concave. Pterygoidal region as described for subgenus, entopterygoids but slightly raised, ectopterygoids forming a raised bead only on anterior portion of floor, which is wide and flat. Palatal foramina diverge from narrow anterior to open posterior, which reaches well behind M^1, though in many Murines these characters vary considerably in a series of skulls and have but little diagnostic value. Bullae small, anterior-posterior length about half that of diastema.

Teeth.—Comparatively large and heavy. Laminae not tilted back; no anterior cingular cusp on M^1. Upper incisors orange, lower pale horny yellow.

Dimensions of type measured in the flesh.—Head and body, 115 mm.; tail, 134 mm.; hind foot, 29 mm.; ear, 22 mm.

Dimensions of skull.—Greatest length, 32 mm.; basal length, 27 mm.; greatest breadth, 16 mm.; nasals, 11.8 x 4 mm.; interorbital breadth, 5 mm.; width of braincase, 14 mm.; palate length, 15.8 mm.; diastema, 8 mm.; palatal foramina, 6 x 2 mm.; upper molars, 5.5 mm.

Habitat.—Otway Forest, Victoria. Type locality Turton's Pass.

Type.—Adult male in National Museum of Victoria, C197.

Dimensions of a second male, C198.—Head and body, 114 mm.; tail, 124 mm.; hind foot, 28.8 mm.; ear, 21 mm.

Remarks.—The group was previously known by species from West Australia (*albocinereus* Gould [1] and *a. squalosum* Thomas [2]), south-eastern South Australia (*apodemoides* Finlayson [3]), and southern Queensland (*glaucus* Thomas [4]), the largest being *albocinereus*. The much greater size of the present animal, its relatively longer feet and ears, and its larger teeth, distinguish it from other species.

The two specimens were trapped in forest country with a thick undergrowth of scrub which is literally riddled with the "runs" of *Rattus assimilis* Gould. Though a search was made no small burrows were discovered, and it seems probable that the mouse makes its home in fallen logs.

Genus MASTACOMYS Thomas 1882.

Mastacomys fuscus Thomas.

Mastacomys fuscus Thomas, Ann. Mag. Nat. Hist. (5), IX, p. 413, 1882; *id.* Ann. Mag. Nat. Hist. (9), X, p. 550, 1922; Lydekker, B. M. Cat. Fos. Mamm., 1, p. 227, 1885; Ogilby, Aust. Mus. Cat. No. 16, Aust. Mamm., p. 120, 1892; Wood Jones, Mamm. Sth. Aust., III, p. 323, 1925; Finlayson, Trans. and Pro. Roy. Soc. Sth. Aust., LVII, p. 125, 1933.

In the National Museum are five skins (with skulls)*, one spirit specimen, and one separate skull of *Mastacomys*. The skull was found in a sand drift on Swan Island in 1905, three Victorian specimens were taken in 1918, and a fourth was trapped in November of last year. Of the remaining skins one is labelled "West Coast of Tasmania, 1872," the other has no data preserved. Thomas (loc. cit.) recorded an immature female from Victoria, but the whereabouts of the specimen has been in doubt; Mr. M. A. C. Hinton, deputy Keeper of Zoology at the British Museum, has kindly cleared up the matter, and says in a letter "it is B.M. No. 92.4.23.1, collected in Gippsland (no more precise locality given) . . . H.F. 25 mm., E. 13 mm., measured on skin in relaxed condition. It is quite a baby, molars just coming into wear."

*Recently prepared from specimens preserved in alcohol.

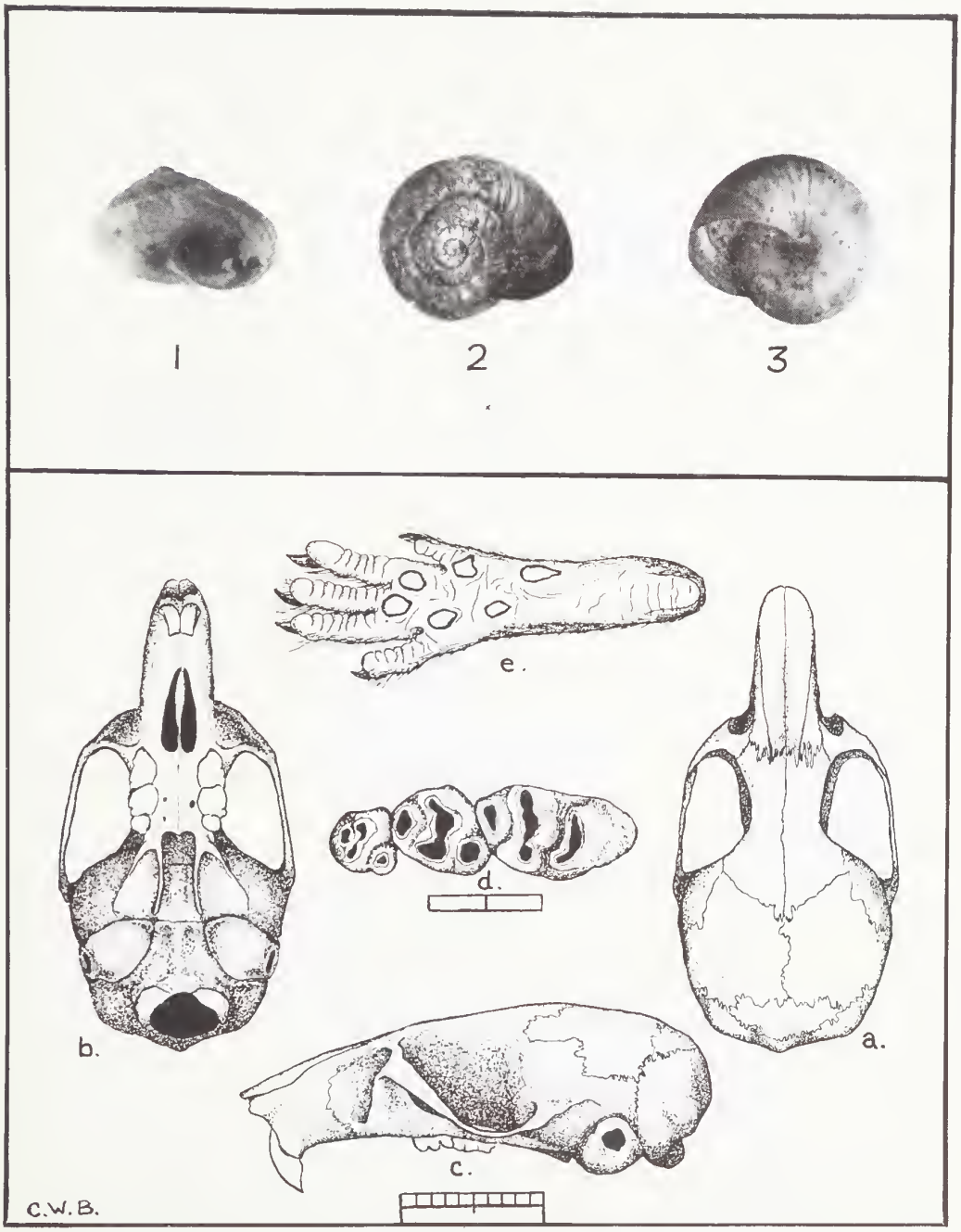
I am much indebted to Mr. H. H. Finlayson for allowing me to compare his Tasmanian series with the Victorian specimens; except for one or two minor variations they are identical. No Victorian specimen is as large as the largest that he records (loc. cit.), but an allowance for shrinkage due to prolonged immersion in alcohol must be made. The tails of the Victorian specimens are consistently longer than those of the Tasmanian series, and expressed as a percentage of head and body length average 73% (Victoria) against 64% (Tasmania) for animals of the same general size. Victorian specimens, therefore, may be distinguished from *Rattus lutreola* not by their shorter, but by their more slender tails. The base of the tail, immediately beyond the body hair, of *R. lutreola* is 6 mm. in diameter; that of *Mastacomys*, of similar H. and B. length, is 4 mm. On the whole the colour of the pelage of the Victorian series is brighter, the terminal band being more ochraceous, but there is a certain amount of variation and specimens from the two States grade into an unbroken colour series.

The skulls are identical. There is a wide variation in the breadth of the incisor teeth, but this cannot be correlated with locality, nor, apparently, with age.

The Victorian specimens are therefore recorded as *Mastacomys fuscus* Thomas, their slightly greater tail length (the only consistent difference) not being considered sufficient, alone, to warrant separation from the Tasmanian species.

Three specimens were donated by the late H. Quiney of Mortlake. He sent a male (Nat. Mus. No. R.1715) and a young female (R.1713) from Laver's Hill in the Otway Forest, and an adult female (C134) from his home at Mortlake, which is situated in the open plains 50 miles N.W. of the Otway Forest area; possibly he collected this specimen also in the Otway Ranges.

The recently trapped male was taken on the edge of a clearing overgrown with bracken fern at Olangolah, near Beech Forest, at the head of the Gellibrand River (1800 feet). The surrounding forest is thick, heavily scrubbed, and very wet, the average rainfall of the district being over 60 inches. *Rattus assimilis* in considerable numbers was caught in the same place, but *R. lutreola* is not found in the locality. Near the trap were many scratchings, smaller and shallower than bandicoot scratches, which had evidently been made in search of a Puff-ball (*Lygoperdon*), fragments of which were lying amid the disturbed earth. Bandicoots are unknown in the locality, *R. assimilis* does not usually excavate for food in this way, and the scratches may probably be attributed to *Mastacomys*. It is hoped, in the



Thalassohelix translucens, sp.n., Figs. 1–3. *?Pseudomys (Gyomys) fumeus sp.n.*, figs. a–e.

near future, to clear up this point, and to gather further information regarding the habits of the animal.

Dimensions of Victorian Specimens of *Mastacomys fuscus* Thomas.

BODY MEASUREMENTS.

Reg. No.	C199 : ♂	R5715 : ♂	C134 : ♀	R5713 : ♀
	mm.	mm.	mm.	mm.
Head and body	173	172	162	110
Tail	124	123	119	85
Hind foot	32	34	31	30
Ear	21	21	20	17.5

SKULLS.

Greatest length		40	39	34
Basal length		35	34	29
Greatest breadth		22.5	22	19
Nasals		15.8 x 5.8	15.5 x 4.8	13 x 4
Interorb. breadth		4	4	4
Braincase, width		16.3	16	15
Palate, length		22	22	19
Palatal foramina		8	7.5	6.8
Diastema		10.3	10	7.5
Upper Molars		10	10	9.5

Plate XVIII.

Pseudomys (*Gyomys*) *fumeus* sp. n.

a. dorsal, *b*. ventral, *c*. lateral views of skull, *d*. molar teeth, *e*. pes. *a*, *b*, *c*, and *e*×2. *d*×8.

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1. J. Gould. Five New Mammals. Proceedings Zoological Society of London, 1845, p. 78.
2. O. Thomas. On Mammals from Western Australia. Proceedings Zoological Society of London, 1906, p. 776.
3. H. H. Finlayson. Preliminary Descriptions of Two New Mammals from South Australia. Transactions and Proceedings Royal Society of South Australia, LVI, p. 170, 1932.
4. O. Thomas. New Australian Muridae of the Genus Pseudomys. Annals and Magazine of Natural History, Eighth Series VI, p. 609, 1910.

ADDITIONS TO THE TERTIARY MOLLUSCA OF VICTORIA.

By the Rev. E. H. Chapple.

Plate XIX.

The type specimens of the tertiary mollusca described below are in the National Museum. With one exception, all were collected by the present author.

Class **PELECYPODA.**

Family **CRASSATELLITIDAE** Dall.

Genus SALAPUTIUM Iredale 1924.

Salaputium corioensis, sp. nov.

Plate XIX, figs. 1, 1a.

Holotype, a right valve from West Beach, Corio Bay, Reg. No. 13685.

Description.—Shell subquadrate, somewhat convex at umbo, depressed towards anterior margin; a faint median ridge extends from umbo to post-ventral margin. Umbo sub-central, directed anteriorly; lunule well defined, long, not striate; dorsal margin fairly straight; anterior margin rounded; posterior obliquely angular; ventral margin strongly arched posteriorly, tapering towards anterior end of shell. Surface ornament consists of concentric ridges, somewhat flattened and reflected, interspaces plain; no radial ornament. Inner margin of valve bevelled; finely crenulated on inner side of bevelled edge.

Dimensions.—Holotype:—Length, 18 mm.; height, 15 mm.; depth of valve, 4 mm.

Observations.—This fossil resembles *Salaputium communis* (Tate) = *Crassatella communis* Tate in shape, but is larger and, unlike *S. communis*, it has the inner margin crenulated. It also bears some resemblance to *S. aldingensis* (Finlay) = *Crassatella corrugata* Tate, but the latter has a plain margin and is striate between the corrugations.

Localities.—West Beach, Corio Bay (Type). North bank of Mitchell River above bridge 10 miles upstream from Bairnsdale.

Geological Horizon.—Barwonian (Oligocene or Miocene).

Class **GASTEROPODA.**

Family **TURRIDAE** Hedley 1922.

Genus TURRIS Müller 1766.

Turris janjukiensis, sp. nov.

Plate XIX, figs. 2, 2a.

Holotype, Reg. No. 13686 ; paratype, Reg. No. 13687 ; both from Bird Rock Cliffs, Torquay.

Description.—Shell fusiform ; protoconch consists of two smooth convex whorls devoid of ornament, tip slightly oblique, immersed. Body whorl ventricose, tapering to acute spire of six convex whorls which bear spiral lirae ; lirae on anterior portion of whorls bold, acute, undulating, interspaces being wider than lirae ; posterior half of whorls sulcate, finely lirate ; penultimate whorl bears five principal lirae on its anterior face ; suture well defined, margined anteriorly with two close-set lirae. Body whorl sulcate, finely lirate anterior to suture ; four or five bold lirae on periphery ; anterior to this they become fainter as they approach canal, interspaces carrying a fine thread. Transverse growth-lines not very conspicuous. Aperture ovate ; outer lip thin, fragile, no available example being perfect ; sinus broad (deduced from growth-lines) ; canal long, straight, narrow.

Dimensions.—Holotype.—Length, 31 mm. ; breadth, 10 mm. ; length of aperture, 6 mm. ; of canal, 10 mm.

Locality.—Bird Rock Cliffs, Spring Creek, Torquay.

Geological Horizon.—Janjukian (Miocene).

Genus GEMMULA Weinkauff 1876.

Gemmula gellibrandensis, sp. nov.

Plate XIX, figs. 3, 3a.

Holotype, Reg. No. 13688 ; paratype, Reg. No. 13689 ; both from near Princetown.

Description.—Shell narrowly fusiform, with long scalar spire. Protoconch consists of two convex whorls ; initial portion slightly inflated, oblique ; anterior whorl costate. Spiral whorls nine, squarely shouldered, the keel consisting of two raised, close-set coarsely granulose lirae ; in front of keel whorls are flattened, the spiral lirae being bold and rounded, four on penultimate whorl with a thread-like lira in interspaces ; posterior area slightly sulcate, carries two or three fine lirae ; suture is channelled, marginate. Body whorl not inflated ; ornament similar to that on spire. Whole shell traversed by numerous close-set oblique growth-lines, most marked in interspaces. Aperture narrowly ovate ; outer lip lirate within ; sinus wide, deep ; columella smooth, nearly straight, its margin very distinct ; canal relatively short, a little incomplete, slightly twisted.

Dimensions.—Holotype.—Length, 18 mm. (approx.); breadth, 6.5 mm.; length of aperture, 4.8 mm.; of canal, 8.0 mm.

Locality.—Land-slide about three-quarters of a mile west of the Gellibrand River and half a mile from the beach, Princetown district. The material has slipped from a bed in the immediate vicinity.

Geological Horizon.—Barwonian (Oligocene or Miocene).

Genus ETREMA Hedley 1918.

Etrema morningtonensis, sp. nov.

Plate XIX, figs. 4, 4a.

Holotype, Reg. No. 13690. Balcombe Bay, Mornington.

Description.—Shell smooth, rather solid, turreted, fusiform. Protoconch of two rounded whorls. Other whorls, five, convex, shouldered at posterior third, abruptly descending to posterior suture; suture well impressed. Whorls obliquely costate, eighteen narrow costae on penultimate whorl, interspaces wider than costae and faintly lirate. Spiral ornament consists of regularly-spaced, somewhat distant lirae, four on penultimate whorl; small granules form where lirae traverse costae, lirae on anterior canal being more pronounced. Aperture ovate; sinus well-defined; outer lip with distinct varix; columella with thin callus; canal short, truncate, a little expanded at front, twisted, recurved.

Dimensions.—Holotype. Length, 10 mm.; breadth, 3 mm.; length of aperture and canal, 4.5 mm.

Locality.—Balcombe Bay, Mornington.

Geological Horizon.—Balcombian (Oligocene).

Genus GURALEUS Hedley 1918.

Guraleus cuspidatus, sp. nov.

Plate XIX, figs. 5, 5a.

Holotype, Reg. No. 13691. Balcombe Bay, Mornington.

Description.—A small, graceful, elongately fusiform, turreted shell with acute spire. Protoconch, a smooth, acute, apical series of four convex whorls ending in a sharp point. Spire whorls four, graded, shouldered at posterior third, abruptly descending to well marked posterior suture; whorls medially convex. Posterior spire whorls ornamented with distant, acute, oblique riblets, which are not continuous from whorl to whorl, and fade away on anterior portion of penultimate whorl. Spiral ornament consists of close-set fine lirae, interspaces striate. Body whorl elongated, somewhat inflated, with a few rudimentary riblets on shoulder and a well-defined varix a little removed from margin of outer lip. Spiral lirae similar to those on spire, save that those on spire are oblique and coarser. Area posterior to shoulder of whorls is plain. Aperture elongate-oval; outer lip smooth, bevelled, and with a small sub-sutural sinus; columella medially concave; canal open at front, recurved.

New Tertiary Mollusca

Dimensions.—Holotype. Length, 15 mm.; breadth, 5 mm.; length of aperture and canal, 7 mm.

Observations.—This species resembles somewhat the living *Guraleus cuspis* (Sowerby) as figured by W. L. May (Illustrated Index of Tasmanian Shells, 1923).

Localities.—Balcombe Bay, Mornington. Spoil heap of brown coal mine, Altona, near Williamstown.

Geological Horizon.—Balcombian (Oligocene).

Family **TROCHIDAE** Adams 1858.

Genus CALLIOSTOMA Swainson 1840.

Calliostoma balcombensis, sp. nov.

Plate XIX, figs. 6, 6a.

Holotype. Reg. No. 13694. Balcombe Bay, Mornington.

Description.—Shell trochiform, of five convex whorls, exclusive of apex. Protoconch, small, of one-and-a-half turns, tip enrolled at right angles to axis of shell. Whorls spirally lirate throughout, five on penultimate whorl, lirae granulose, with an intermediate fine thread. Suture well impressed. Body whorl ventricose; base convex, lirate but less granulose than on whorls, about eight lirae on base. Aperture subquadrate, pearly within; outer lip thin, crenulate; columella excavated, slightly reflexed.

Dimensions.—Holotype. Length, 9 mm.; breadth, 7 mm.

Observations.—This species is fairly common at Balcombe Bay.

Locality.—Balcombe Bay, Mornington.

Geological Horizon.—Balcombian (Oligocene).

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The author desires to express his thanks to the Director of the National Museum (Mr. D. J. Mahony) for assistance in revisions, and to the Palaeontologist (Mr. R. A. Keble) for access to the Museum collections for purposes of comparison. Also his indebtedness to Mr. F. A. Singleton of the Geology Department (Melbourne University), for many valuable suggestions.

Plate XIX.

Figs. 1a, b. Salaputium corioensis, sp. nov.; holotype. ×1.5.
Figs. 2a, b. Turris janjukiensis, sp. nov.; holotype. ×1.5.
Figs. 3a, b. Gemmula gellibrandensis, sp. nov.; holotype. ×1.5.
Figs. 4a, b. Etrema morningtonensis, sp. nov.; holotype. ×3.
Figs. 5a, b. Guraleus cuspidatus, sp. nov.; holotype. ×3.
Figs. 6a, b. Calliostoma balcombensis, sp. nov.; holotype. ×3.

GRAPTOLITES OF VICTORIA; NEW SPECIES AND ADDITIONAL RECORDS.

R. A. Keble, F.G.S., Palaeontologist, and W. J. Harris, B.A., Hon. Palaeontologist.

Plates XX–XXII.

Nine new species and three new varieties of Graptolites are described below and several species are recorded in Australia for the first time. *Monograptus aplini* T. S. Hall and *Stomatograptus australis* (McCoy) are redescribed. Except where otherwise indicated specimens quoted are in the collections of the Geological Survey of Victoria. All drawings were made with a camera lucida.

Of the new species, *Pterograptus lyricus* is probably the most graceful graptolite known; *Tetragraptus chapmani* and *Cryptograptus circinus* have unusual structural characters; and *Retiograptus pulcherrimus* and *Stomatograptus australis* clearly show the internal clathria.

Several species are common to more than one province. *Diplograptus* (*Glyptograptus*) *euglyphus* occurs in Australia, Europe and America; *D.* (*G.*) *euglyphus* var. *sepositus* in Australia and New Zealand; and *Monograptus pandus* in Australia and Europe. The following Australian species here described have closely related European representatives:— *Didymograptus acriculus* in *D. euodus* Lapworth, *Pterograptus lyricus* in *P. elegans* Holm, *Climacograptus subminimus* in *C. minimus* (Carruthers), *Monograptus spiralis* var. *permensus* in *M. spiralis* Geinitz. The Australian species *Glossograptus pilosus* has an American representative in *G. hystrix* Ruedemann, and *Didymograptus mendicus* has a New Zealand representative in *D. bidens* Keble.

The stratigraphical classification adopted is that of Thomas and Keble (14) for the Silurian and Upper Ordovician, and that of Harris and Keble (9) for the Lower Ordovician, as shown in the following table.

Period.	Series.	Zones.
Silurian	Melbournian Yeringian Keilorian	
Upper Ordovician	Bolindian Eastonian Gisbornian	

Period	Series	Zones.
Lower Ordovician	Darriwilian	D1, D2, D3, D4, D5
	Castlemainian	C1, C2, C3, C4, C5
	Bendigonian	B1, B2, B3, B4, B5
	Lancefieldian	L1, L2, L3, L4, L5

Family **DICHOGRAPTIDAE** Lapworth 1873.

Genus DIDYMOGRAPTUS McCoy 1851.

Didymograptus acriculus, sp. nov.

(Plate XX, Figs. 1*a*, 1*b*, and Text fig. 1.)

Branches several centimetres in length ; incomplete ; less than 0.5 mm. wide at origin but widens rapidly (at 3.5 mm. from sicula 2.0 mm. wide) to 3.5 mm. ; diverging from inconspicuous sicula at slightly more than 180° but rapidly becoming horizontal.

Fig. 1. *Didymograptus acriculus*, sp. nov.

a. Distal thecae (No. 23507). *b*. Proximal thecae (No. 22811). ×4.

Thecae, in proximal portion, 10 or 11 in 10 mm. ; inclined at 30° ; overlapping about half of length. In distal portion, thecae 7 in 10 mm. ; inclined at 50° ; overlapping two-thirds of length ; three times as long as wide ; ventral margins doubly curved ; apertural margins sigmoidal, at 95° to axis of branch and produced into broad, conspicuous denticles.

Remarks.—The sicula is less than 1.0 mm. long and the first theca originates near its aperture. Some branches up to 6 mm. in length have all thecae of the distal type. *D. acriculus* appears to have some thecal characters in common with *D. cuodus* Lapw., see Elles and Wood (1), but it differs from Lapworth's species in the absence of proximal curvature of its branches and in its rapidly increasing and greater distal width.

Associated graptolites.—*Tetragraptus* cf. *quadribrachiatus* (J. Hall), *Isograptus forcipiformis* (Rued.), *Didymograptus nodosus* Harris, *Cryptograptus tricornis* var. *schaferi* Lapworth, *Diplograptus* cf. *coelatus* Lapworth, *Glossograptus pilosus* sp. nov., *Lasiograptus* sp., *Cardiograptus crawfordi* Harris, *Phyllograptus nobilis* Harris & Keble, *Trigonograptus* sp., *Brachiograptus etaformis* H and K., *Atograptus woodwardi* Harris, and other, as yet undescribed, species.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1.

Locality.—Bendigo East, on south side of Bendigo–Axedale Road, about 30 chains east of the Whitelaw Fault.

Didymograptus mendicus, sp. nov.

(Plate XX, fig. 2.)

Branches arising suborally; abruptly curved for first half of thecae 1^1 and 1^2, then very slightly curved and lying within an angle of 70°. Minimum width near sicula under 0.2 mm.; maximum width distally 1.5 mm.; maximum length over 1 mm.

Sicula less than 1 mm. long and relatively broad. Thecae 12 or 13 in 10 mm.; about as long as broad (except 1^1 and 1^2); free for three-fourths length; apertural margins undulate, approximately 105° to axis of branch; ventral margins slightly concave, inclined between 40° and 45°; broadly submucronate. Thecae 1^1 and 1^2 twice as long as broad; proximal half from near origin slightly over 0.1 mm. wide with concentrically curved sides; distal half rapidly widening to 1.4 mm. at aperture.

Remarks.—The first thecae are about 2.0 mm. long, the succeeding thecae 1.5 mm.; an unusual feature. The curvature giving the polypary its dependent form is confined to the narrow half of the first thecae. Later thecae are characteristically broad and have an unusually small overlap in proportion to their breadth. The angle of the aperture varies considerably with the mode of preservation, and in the right hand branch of the holotype (Pl. XX, fig. 2), appears to be considerably more than 105°. The mode of origin of the first thecae is suggestive of the *Leptograptidae*; we have not yet obtained a specimen showing the reverse aspect, but we suspect that a rudimentary double crossing canal is present.

D. mendicus belongs to the *D. bidens* group; *D. bidens*, a New Zealand form recently described by Keble (11), is the

oldest known representative of this characteristic group of dependent *Didymograpti*.

D. mendicus differs from *D. bidens* in the more abrupt proximal curvature of its branches ; in its distally wider angle of divergence ; in its greater distal width ; and in its more closely set thecae. It has, however, the characteristic small overlap, the same ratio of thecal length to breadth, and unusually long first thecae. Unquestionably *D. mendicus* is the Australian equivalent of the New Zealand form, *D. bidens*, and it is associated with a similar graptolite fauna.

Associated graptolites.—*Didymograptus protobifidus* Elles, *Tetragraptus quadribrachiatus* (J. Hall), *T. similis* (J. Hall), *Phyllograptus* spp., etc.

Horizon.—Lower Ordovician, Castlemaine Series, Zone C5 or C4.

Locality.—Connell's Mine, east bank of Werribee River, 12 miles south of Daylesford.

Genus TETRAGRAPTUS Salter 1863.

Tetragraptus chapmani, sp. nov.

(Plate XX, figs. 3*a*, 3*b*)

The obverse view is the only one so far seen. Sicula 1.2 mm. long, 0.7 mm. wide. Theca 1^1 originates suborally, apparently a little below aperture of sicula ; theca 1^2 crosses a little above 1^1 and lies slightly downwards across sicular aperture. Funicle apparently straight ; consists of three pairs of thecae (1^1, 1^2, 2^1, 2^2, 3^1 and 3^2) ; 7.7 mm. long. Thecae 3^1 and 3^2 bifurcate and give rise to four slender branches of second order uniformly under 0.5 mm. wide. Secondary branches long (in one case 96 mm.), sinuous, irregular in direction. Thecae 9 to 11 in 10 mm. ; between two and three times as long as wide ; overlap one-fourth or less of length ; ventral margins inclined between 20° and 25°, apertural margins at 70° to axis of branch ; both slightly concave.

Remarks.—The thecae appear to be simple tubes, not unlike those of some *Bryograpti*, but more specialised. Their apertures come into view in rotation as if the thecae were arranged spirally ; this is perhaps due to torsion of the branches. Specimens seldom have more than one thecae at a time laterally compressed, and this makes the study of thecal structure difficult, even in specimens in partial relief.

The angle between each pair of branches of the second order at the end of the funicle varies considerably and is of no specific importance.

We regard *T. chapmani* as one of the most important and characteristic of Victorian graptolites ; in fact we are not aware of any other member of the Dichograptidae with such peculiar

structural details. We anticipate that better specimens will throw light on both structure and functions of graptolites; we have, therefore, named this unusual form after Mr. F. Chapman whose researches have so greatly advanced Australian palaeontology.

Associated graptolites. *Clonograptus tenellus* Linnarsson, *Bryograptus* sp., *Didymograptus aureus* T. S. Hall, *D. latens* T. S. Hall, *D. latus* T. S. Hall, *Tetragraptus fruticosus* (J. Hall) (4 br.), *T. quadribrachiatus* (J. Hall), *T. approximatus* Nicholson, *T. decipiens* T. S. Hall, *T. acclinans* Keble, *Loganograptus logani* J. Hall.

Horizon.—Lower Ordovician, Bendigo and Lancefield Series, Zones B5 and L2.

Localities.—Holotype, gully near junction of Kangaroo Creek and Lerderderg River, 2 miles below Blackwood (left bank); paratype, Antimony Mine, Lerderderg River, 1 mile below Blackwood (right bank).

Tetragraptus decipiens T. S. Hall var. *bipatens* nov.

Tetragraptus decipiens, T. S. Hall, Proc. Roy. Soc. Vict., xi (n.s.), 2, 1899, p. 168, pl. xvii, xviii.

(Text figs. 2, 3.)

Sicula 1.4 mm. long, 0.6 mm. wide. Theca 1^1 originates within apertural third of sicula and grows downwards at approximately 110° to sicular axis; theca 1^2 turns in opposite direction and forms with 1^1 a funicle enclosing an angle of 140°. Thecae 1^1 and 1^2 bifurcate, giving rise to branches of second order, 13 mm. or more in length, normally straight, but usually flexed by compression. Secondary branches widen rapidly to 0.8 mm. and maintain that width throughout.

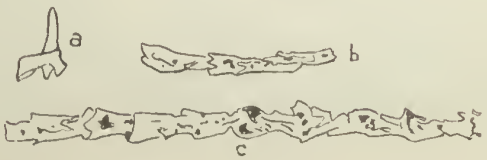


Fig. 2. *Tetragraptus decipiens* T. S. Hall var. *bipatens* nov. *a.* Sicula and theca 1 (No. 25094). *b.* (?) serrated or irregular apertural margins on branch of second order (No. 25058). *c.* Proximal portion of branch of second order showing peculiar arrangement of thecae (holotype No. 25094). ×4.

Thecae, long tapering tubes a little more than three times as long as wide; divergent; overlapping one-fourth of length; 8 in 10 mm.; ventral margins straight, inclined to axis of branch at 20°. Thecal apertures of holotype either acutely dentiform, sigmoidal, concave or straight, according to mode of compression.

Remarks.—In some specimens the sicula has a short inconspicuous nema. The variable aspect of the polypary (text figs. 3*a*–3*g*), due to mode of compression, is suggestive in regard to other quadribrachiate *Tetragrapti*. The funicle may appear angular or straight, and branches of the second order straight or flexed. The funicle normally encloses an angle of 140° (text figs. 3*a*, 3*b*). Assuming that the whole polypary was

suspended by a nema, the secondary branches continue on the same slope as the funicle ; in other words they were not horizontal as is generally assumed for *T. quadribrachiatus*, see J. Hall (6, Pl. 5).

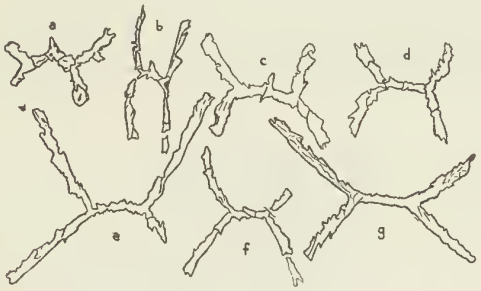


Fig. 3. *Tetragraptus decipiens* T. S. Hall var. *bipatens* nov. ; polyparies subvertically compressed. *a*. Obverse view ; sicula and funicle turned over, branches of second order flexed and contorted (No. 25097). *b*. Reverse view (No. 25016). *c*. Sicula turned over, funicle partly turned over and elongated, lower branches flexed (No. 25041). *d*. (No. 25087) ; *e*. (No. 25055) ; *f*. (No. 25058) ; *g*. almost vertically compressed (No. 25061) ; sicula apparently compressed against funicle. ×2.

The angle contained by pairs of secondary branches is between 100° and 105°.

Whether the funicle is straight or angular when compressed, or the branch straight or flexed, depends on how the polypary came to rest ; this was usually on the distal ends of the branches, and it then became fixed with the aperture of its sicula opening downwards. The funicle and sicula would thus be compressed last, either vertically or slightly subvertically ; vertical compression would elongate the funicle and press the sicula against it (text figs. 3*d*–3*g*), but subvertical compression would cause funicle and sicula to bend over and display a lateral aspect (text figs. 3*a*, 3*b*). In one example (text fig. 3*c*) the sicula has been turned over and the funicle is elongated. The following are measurements of the funicle under different modes of compression :—

Incidence of pressure	Vertical	Slightly Subvertical	Subvertical	Subvertical
Shape of funicle	straight	slightly angular	slightly angular	angular
Position of sicula	elongated, compressed against funicle	elongated, compressed against funicle	elongated, turned over	not elongated, turned over
Length in mm.	2.3 (Fig. 3*d*) 2.5 (,, 3*f*) 3.0 (,, 3*g*)	2.5 (Fig. 3*g*)	3.2 (Fig. 3*c*)	2.1 (Fig. 3*a*) 1.7 (,, 3*b*)

Elongation of the funicle is accompanied by slight flexing of the branches (text figs. 3*c*–3*g*) ; subvertical compression and turning over of the sicula and funicle, by strong flexing and distortion (text figs. 3*a*, 3*b*).

If the polypary came to rest on the apex of the sicula and the distal ends of two branches, all four branches would be compressed on one side of the funicle ; this has been observed in *T. decipiens.*

T. decipiens var. *bipatens* differs from *T. decipiens*, see T. S. Hall (7), in the following respects :—

	T. decipiens var. *bipatens.*	*T. decipiens.*
Branches of second order.	Widen rapidly to 0.8 mm. and maintain that width throughout	Widen from 0.6 mm. rapidly to 1.5 mm.
Thecae—		
Number in 10 mm. ..	8 or 10	9 or 11
Length to width	3 : 1	4 : 6
Angle of inclination ..	20°	27°
Overlap	$\frac{1}{4}$	$\frac{1}{2}$

Associated graptolites.—*Clonograptus* cf. *rigidus* J. Hall, *Bryograptus* spp., *Tetragraptus approximatus* Nicholson, *T. acclinans* Keble, *T. decipiens* T. S. Hall, *T. fruticosus* (J. Hall), *Didymograptus aureus* T. S. Hall, *D. latens* T. S. Hall, *D. latus* T. S. Hall, *Loganograptus logani* J. Hall, etc.

Horizon.—Lower Ordovician, Bendigo Series, Zone B5 ; probably also Lancefield Series, Zone L1.

Locality.—Antimony Mine, Lerderderg River, one mile downstream from Blackwood.

Genus PTEROGRAPTUS Holm 1881.

Pterograptus lyricus, sp. nov.

(Plate XX, fig. 4 and text fig. 4.)

Polypary consisting of (a) two outer monopodial branches widening from 0.2 mm. near sicula to 0.5 mm. in distal portion, approximately straight for at least 1.2 cm. and lying within an angle of 65°, then curving gracefully for rest of length (3.5 cm.), first away from, then towards, axis of polypary, the curve increasing at distal extremity until ultimately trending at right angles to axis ; (b) forty or more inner branches of like dimensions arising from consecutive monopodial thecae, forming at point of origin an acute angle with branch of first order, those arising near sicula being slightly curved, curvature increasing with remoteness of branch, the most distal curving gracefully upwards and inwards and converging like outer branches towards axis of polypary. Sicula 0.5 mm. long. Thecae long, narrow, simple tubes ; in proximal portion 10 or 11 in 10 mm. ; about four times as long as wide, over-

lapping one-half to two-thirds of length; inclined at about 25°; apertural margins straight, normal to axis of branch; in distal portion, about 8 in 10 mm., in contact for a small fraction of length, apertural margins introverted.

Remarks.—At first sight the inner branches seem to be given off in pairs, suggesting Ruedemann's genus *Syndyograptus* (see Ruedemann, 13), but closer inspection shows that they arise serially.

Fig. 4. *Pterograptus lyricus*, sp. nov. Polyparies bilaterally compressed. *a*. Proximal portion showing inner branches arising serially (No. 13755 Nat. Mus.). *b*. Proximal portion (No. 13756 Nat. Mus.). ×4. Paratypes, Turner's Quarry, 5 miles W. of Hastings.

Associated graptolites.—*Tetragraptus* cf. *quadribrachiatus* (J. Hall), *Isograptus ovatus* (T. S. Hall), *Cryptograptus tricornis* (Carruthers), *Glossograptus hincksii* (Hopkinson), *Climacograptus riddellensis* Harris, *Diplograptus* (*Glyptograptus*) *euglyphus* (Lapworth).

Horizon.—Lower Ordovician, Darriwil Series, Zone D1 (uppermost beds).

Localities.—Holotype and paratypes, Turner's Quarry, Allot. 27B, Parish of Bittern, 5 miles west of Hastings (Mornington Peninsula); Sandy's Creek, near confluence with Merrijig Creek, Tabberabbera (Gippsland); Howqua River, above Eight Mile Creek.

Family **DIPLOGRAPTIDAE** Lapworth 1873.

Genus CLIMACOGRAPTUS J. Hall 1865.

Climacograptus uncinatus, sp. nov.

(Plate XX, figs. 5*a*–5*c*.)

Polypary widening from pointed proximal end to 2.5 mm. in 3 mm. and maintaining that width. Sicula obscure. Thecae 12 to 14 in 10 mm. Two fairly stout curved spines, about 2.0 mm. long, arise about 2.0 mm. from proximal end.

Remarks.—The only polyparies found exhibit scalariform or subscalariform aspects, probably because the curved spines in the proximal portion function as septal spines which prevent the polypary coming to rest except with the thecal apertures at right angles to the bedding. A subscalariform specimen

indicates that the thecae are approximately 2.0 mm. long and overlap about one-half their length.

Associated graptolites.—*Retiograptus pulcherrimus*, sp. nov., *Climacograptus missilis* Keble & Harris, *C. tubuliferus* Lapworth, *D. carnei* T. S. Hall, *Leptograptus eastonensis* Keble & Harris, *L. flaccidus* J. Hall.

Horizon.—Upper Ordovician, Bolinda Series.

Locality.—About 10 chains west of Jordan River where it crosses the Yarra Track, between Matlock and The Oaks.

Climacograptus subminimus, sp. nov.

(Plate XX, figs. 6*a*, 6*b*.)

Polypary 15 mm. long, widening rapidly to maximum width of about 1 mm. Virgella conspicuous. Virgula relatively stout; 6 mm. or more in length. Thecae 10 or 11 in 10 mm.; long, overlapping from one-half to two-thirds of length; free outer edges straight and vertical; apertural margins horizontal, lying within sub-elliptical excavations occupying one-third width of polypary and one-third of ventral margin. Septum incomplete.

Remarks.—In some specimens there is a suggestion of a rudimentary basal spine. *C. subminimus* seems intermediate between *C. minimus* Carruthers and *C. brevis* Elles and Wood; from *C. minimus* it is distinguished by its lesser width, and from *C. brevis* by its greater thecal overlap. This graptolite is referred to *Climacograptus* with some hesitation, but its inclusion in the genus is supported by comparing it with figures of related species; see Elles and Wood, 2, p. 193, fig. 125*b*.

Associated graptolites.—The same as with *Didymograptus acriculus*.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1.

Locality.—Bendigo East, on south side of Bendigo–Axedale Road, about 30 chains east of Whitelaw Fault, and at other outcrops of the same belt of strata in this locality.

Genus DIPLOGRAPTUS McCoy 1850.

Subgenus GLYPTOGRAPTUS Lapworth 1880.

Diplograptus (*Glyptograptus*) *euglyphus* Lapworth.

Diplograptus (*Glyptograptus*) *euglyphus*, Lapworth, Ann. Mag. Nat. Hist. [5], *v*, 1877, p. 166, pl. iv.

(Plate XXI, fig. 1.)

In some of the Upper Darriwil beds a *Diplograptus* occurs which is intermediate between *D.* (*G.*) *euglyphus* and *D.* (*G.*) *teretiusculus* (Hisinger), see Elles and Wood (3). The maximum

length observed is 3.0 cm. ; it widens from about 1.0 mm. in the proximal portion to 2.0 mm. within 4.5 mm. and has, therefore, a robustness suggestive of *D.* (*G.*) *teretiusculus*. The virgella is fine and short, like that of the American forms of *D.* (*G.*) *euglyphus* described by Ruedemann (13). No basal spines have been detected. The thecae are sacculate above and impressed below, 2.5 mm. long, overlap about one-half, and have undulate apertural margins. Thecae 11 to 12 in 10 mm. in proximal part, and 9 to 10 in 10 mm. in distal part of polypary. Until we have examined a wider range of material we prefer to regard this form as *D.* (*G.*) *euglyphus*.

Associated graptolites.—Graptolites associated with this form are typical of the Gisborne Series (Upper Ordovician) or of Zone D1, Darriwil Series (Lower Ordovician).

Horizon.—Lower Ordovician, Darriwil Series, Zone D1; and Upper Ordovician, Gisborne Series.

Localities.—One Mile Creek, Enoch's Point, Goulburn River; Howqua River above Eight Mile Creek; Geological Survey Locality, Ba67, Quarter Sheet 6 S.E., at the junction of Riddell's and Jackson's Creeks, near Gisborne; Bendigo East, on the Bendigo–Axedale Road, about 30 chains east of the Whitelaw Fault; Turner's Quarry, Allot. 27B, Parish of Bittern, Mornington Peninsula.

Diplograptus (*Glyptograptus*) *euglyphus* Lapworth

var. *sepositus* nov.

(Plate XXI, figs. 2*a*–2*e*.)

Polypary 21 mm. in length ; widening from 0.7 near sicula to about 1.8 mm. in 6 mm. and then of uniform width to distal extremity. Sicula about 0.6 mm. long ; furnished with short, fine virgella and curved spine. Thecae 8 to 10 in 10 mm., similar to those of *D.* (*G.*) *euglyphus*.

Remarks.—All our specimens have a subscalariform aspect but vary considerably in appearance with slight variation in the angle of compression. Some modes of preservation suggest introversion in the apertural region. In some polyparies the first thecae have grown to an abnormal size. The development of the first thecae is obscure, but Th. 1^1 seems to originate near the aperture of the sicula and turns quickly, growing outwards ; it is furnished with a small apertural spine. Th.1^2 grows outwards and upwards.

D. (*G.*) *euglyphus* var. *sepositus* has much in common with the form described by Elles and Wood (3) as *D. teretiusculus* var. *euglyphus* and that relegated by Ruedemann (13) to *D. euglyphus*, more with the latter than with the former. It

differs from Elles and Wood's form in having thecae more closely set, in its smaller maximum width and wider proximal portion; from Ruedemann's form in having a smaller angle of the thecae and a persistent basal spine. Though Ruedemann does not illustrate the proximal thecae and no definite conclusion can be based on his figure, the differences between his form and ours appear to be of varietal importance only.

Associated graptolites.—As with *D.* (*G.*) *euglyphus.*

Horizon.—Lower Ordovician, Darriwil Series, Zone D1; Upper Ordovician, Gisbornian Series.

Localities.—The same as those of *D.* (*G.*) *euglyphus.*

Subgenus AMPLEXOGRAPTUS Elles and Wood 1907.

Diplograptus (*Amplexograptus*) cf. *perexcavatus* Lapworth.

Diplograptus perexcavatus, Lapworth, Cat. West. Scott. Foss., II, 1876. p. 6, pl. ii.

Diplograptus (*Amplexograptus*) *perexcavatus*, Elles and Wood, Mon. Brit, Grapt., pt. vi, p. 267, Pal. Soc., lxi, 1907, pl. xxxi.

(Plate XXI, fig. 3.)

A few specimens of *D.* (*A.*) cf. *perexcavatus* have been collected at Bendigo East and Sunbury. All are distorted or fragmentary, particularly in the proximal portion, and all specific criteria cannot be checked. The largest fragment is 11.0 mm. long and has a maximum breadth of 2.0 mm. at the distal extremity. Thecae from 12 to 14 in 10 mm., preserved in both scalariform and subscalariform aspects. In scalariform (*Climacograptus*) aspect, the excavations are deep, occupying one-half the breadth of the polypary; in subscalariform aspect, the ventral margins of thecae have a double curvature, but less pronounced than that of some British forms.

Associated graptolites.—*Diplograptus coelatus* Lapworth.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1; Upper Ordovician, Gisbornian Series.

Localities.—Small washout east of Sunbury–Gisborne Road, about 2 miles N.W. of Sunbury; Bendigo East.

Genus TRIGONOGRAPTUS Nicholson 1869.

Trigonograptus sp.

(Plate XXI, figs. 4*a*, 4*b*.)

Polypary about 2 cm. long, at proximal end approximately 1 mm. wide, widening to 3.1 mm. in 1 cm. and then narrowing to a pointed distal extremity.

Thecae 11 to 13 in 10 mm., slightly curved, inclined at 40° to 50°; in contact throughout; apertural margins forming a more or less broken line representing margin of compressed polypary. Test somewhat attenuate.

Remarks.—The median suture is indistinct but is apparently wider than that of *T. wilkinsoni* T. S. Hall or *T. ensiformis* J. Hall (see T. S. Hall, 8, and J. Hall, 6, pl. 14). Its spindle-shaped polypary and the absence of subparallel margins may be merely characteristic of a stage of development. Until better specimens are available, we have contented ourselves by referring it to its genus.

Associated graptolites.—The typical assemblage of Zone D1, Darriwil Series; see *Didymograptus acriculus*, p. 167.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1.

Locality.—Bendigo East, on south side of Bendigo–Axedale Road, about 30 chains east of Whitelaw Fault, and at other local outcrops of the same strata.

Genus GLOSSOGRAPTUS Emmons 1855.

Glossograptus pilosus, sp. nov.

(Plate XXI, figs. 5*a*–5*d*.)

Polypary oval, fusiform or subcircular; 3.6 mm. long, about 2.0 mm. broad. Sicula about 1.0 mm. long. Thecae from 22 to 27 in 10 mm.; overlap three-fourths of length; ventral margin straight; apertures everted; from sicula to distal extremity facing downwards, outwards, and upwards; furnished with robust, arcuate, blunted spines. Virgula stout, about 1.5 mm. long.

Remarks.—*G. pilosus* differs from *G. hystrix* Rued. (see Ruedemann, 12) in general shape, relative shortness, more closely set thecae, and its arcuate spines. The distal thecae may grow to abnormal size and produce unusually long spines. The sicula has sometimes an extremely fine virgella. The septal spines are robust though seldom visible. The apertural spines often widen into a dilation, suggesting affinities to the genus *Lasiograptus*.

Associated graptolites.—Those found with *Didymograptus acriculus*.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1.

Locality.—Bendigo East, on south side of Bendigo–Axedale Road, about 30 chains east of Whitelaw Fault; and occasionally in other local outcrops of the same strata, as in Sect. xxix, Parish of Huntley.

Genus CRYPTOGRAPTUS Lapworth 1880.

Cryptograptus circinus, sp. nov.

(Plate XXI, figs. 6*a*–6*e*, and text fig. 5.)

Polypary widening rapidly to approximately 3.0 mm., attaining 18 mm. in length. Sicula obscure; minute virgella. Thecae 13 to 15 in 10 mm.;

tubular ; apertures open obliquely downwards and outwards ; overlap one-half of length ; submucronate.

Fig. 5. *Cryptograptus circinus*, sp. nov. Proximal end (No. 22913, syntype). ×3.

Remarks.—*C. circinus* differs from *C. tricornis* Carruthers in its greater width, in its less widely spaced thecae, and in thecal characters (see Elles and Wood 4). Thecae opening obliquely downwards and outwards indicate retroversion ; it is, however, difficult to trace the walls of the thecae into the body of the polypary. Some specimens show torsion (Pl. XXI, fig. 3*d*); the aspects of the polypary are not as varied as in *C. tricornis*, bilateral aspect being common and suggesting that the cross section of the polypary is not so concavo-convex as it is in *C. tricornis*.

Associated graptolites.—As with *Didymograptus acriculus*.

Horizon.—Lower Ordovician, Darriwil Series, Zone D1.

Locality.—Common at Bendigo East in outcrops of strata of the Darriwil Series.

Genus RETIOGRAPTUS J. Hall 1865.

Retiograptus pulcherrimus, sp. nov.

(Plate XXII, figs. 1 and text fig. 6.)

Polypary 12 cm. or more in length, widening proximally to 2.0 mm. in the first few centimetres and maintaining that width throughout. Sicula furnished with spines. Polypary consists of a series of superimposed rhombic areas

Fig. 6. *Retiograptus pulcherrimus*, sp. nov. Portion of polypary, reproduced from photograph, showing consecutive pairs of rhombs and alternating thecae. (No. 26700 [1], holotype). ×5.

outlined by strands. Subvertical sides of consecutive pairs of rhombs from an outer and inner angle; thecae project from the outer angles, successive thecae being on opposite sides of the polypary, and separated by rhombic interspaces. Apertures subangular, each with a short blunt spine. Longitudinally throughout the polypary are two septal strands, one zigzag (obverse aspect), and the other straight (reverse aspect).

Associated graptolites.—*C. uncinatus*, sp. nov., *C. missilis* Keble & Harris, *C. tubuliferus* Lapworth, *Diplograptus carnei* T. S. Hall, *Leptograptus eastonensis* Keble & Harris, *L. flaccidus* J. Hall, etc.

Horizon.—Upper Ordovician, Bolinda Series.

Locality.—About 10 chains West of Jordan River where it runs under Yarra Track between Matlock and The Oaks.

Family **MONOGRAPTIDAE** Lapworth 1873.

Genus MONOGRAPTUS Geinitz 1852.

Monograptus aplini T. S. Hall, emended Keble and Harris.

M. aplini T. S. Hall, Vict. Grap., Pt. IV, Proc. Roy. Soc. Vict., Vol. XXVII (n.s.) Pt. 1, p. 114, 1914, pl. xvii, fig. 17.

(Plate XXII, figs. 2*a*–2*i*, and text fig. 7.)

T. S. Hall's original description (8) is as follows: "Very minute, curved toward the ventral side. The most complete specimens form an open U-shaped figure. Thecae 18 to 20 in 10 mm.; apparently coiled in a rounded mass, and opening laterally. Sicula about 1 mm. long and narrow." He adds that "*M. aplini* is closely allied to *M. exiguus* Nicholson, and *M. nodifer* Tornquist, but its minute size separates it from them." Hall's type is from Keilor, Victoria. The type, as figured by him, does not show the characteristic form of the polypary. On this account, and influenced by the words "very minute" in Hall's diagnosis, we failed at first to identify our specimens with *M. aplini*. We have refigured the type specimen (Pl. XXII, fig. 2*a*), together with another specimen from the same slab (Pl. XXII, fig. 2*h*.)

Although *M. aplini* resembles *M. exiguus* Nicholson and *M. nodifer* Tornquist (see Elles and Wood, 5) in general appearance, we are convinced after examining hundreds of specimens that the thecae of *M. aplini* are curved tubes opening, as Hall observes, laterally, the apparent coils being due to compression of the apertural margins. Specimens from Enoch's Point are usually more robust than those from Keilor and have more widely spaced thecae (about 14 in 10 mm.).

Associated graptolites.—*M. pandus* Lapworth (Pl. XXII, figs. 3*a*, 3*b*), *M. spiralis* Geinitz var. *permensus* nov., *M. scanius* Tullberg (Pl. XXII, fig. 4), *M.* cf *dubius* Suess, *M. turriculatus* Barrande, *Stomatograptus australis* (McCoy).

Horizon.—Silurian, Keilor Series, near top.

Localities.—Keilor; Enoch's Point, a few chains north of where the abandoned Darlingford-Enoch's Point Road crosses Knowles Creek.

Monograptus spiralis (Geinitz) var. *permensus* nov.

Graptolithus spiralis, Geinitz, Neues Jahrb. f. Min., 1842, p. 700, pl. x.

Monograptus spiralis B. subconicus, Törnquist, Siljansor. Grapt., ii, 1892, p. 35, pl. iii.

M. spiralis, Elles and Wood, Mon. Brit. Grapt., ix, Pal. Soc., lxvi, 1912, p. 475, text figs. 331 *a*, *b*, *c*, pl. xlviii.

Polypary robust, widening from slender proximal portion persistently through its length; coiled into loose spiral. Thecae on convex margin, 12 to 14 in 10 mm.; of uniform type; subtriangular; scarcely overlapping; with barbed retroverted apertural region, slightly smaller and more triangular at proximal than at distal end.

Fig. 7. *Monograptus spiralis* Geinitz var. *permensus* nov. *a*. Triangular and partly retroverted thecae (No. 29306). *b*. Distorted polypary with usual form of thecae (No. 29243). *c*. Triangular thecae (No. 29295). *d*. Typical spiral shape of polypary (No. 29253). *e*. Spirals (No. 29255). ×4.

Remarks.—The polypary forms an irregular spiral, never well displayed and seldom complete. Torsion probably accounts for the scalariform aspect and even for the appearance of thecae on the inner margin of some specimens. The varietal form differs from the parent species in the spacing of thecae, typical *M. spiralis* having 8 or 9 in 10 mm., its variety *permensus* 12 to 14 in 10 mm. (see Elles and Wood 5).

Associated graptolites and Horizon.—The same as for *M. aplini*.

Locality.—Enoch's Point, a few chains north of where the abandoned Darlingford-Enoch's Point Road crosses Knowles Creek.

Monograptus cf. *scanius* Tullberg.

Monograptus scanius, Tullberg, Skänes Grapt., ii, 1883, p. 26, pl. ii.

(Plate XXII, fig. 3.)

A form comparable with *M. scanius* Tullberg (see Elles and Wood 5) occurs at Knowles Creek, Enoch's Point, at somewhat lower horizon than it does in Britain. Until more specimens are available we consider that a figure will be sufficient description.

Associated graptolites, Horizon, and Locality.—The same as for *M. spiralis* var. *permensus*.

Monograptus pandus (Lapworth).

Monograptus lobiferus var. *pandus*, Lapworth, Proc. Belfast Nat. Field Club, 1877, p. 129, pl. vi.

Monograptus pandus, Elles and Wood, Mon. Brit. Grapt., ix, Pal. Soc., 1912, p. 421, text fig. 283, pl. xlii.

(Plate XXII, figs. 4*a*, 4*b*.)

This species is now recorded for the first time in Victoria; it agrees with Lapworth's description and figures in all essentials; see Elles and Wood (4). This graptolite is not uncommon at Knowles Creek, Enoch's Point.

Associated graptolites, Horizon, and Locality.—The same as for *M. spiralis* var. *permensus*.

Family **RETIOLITIDAE** Lapworth 1873.

Genus STOMATOGRAPTUS Tullberg 1890.

Stomatograptus australis (McCoy).

(Plate XXII, figs. 5*a*–5*d*.)

Retiolites australis McCoy, Prod. Pal. Vict., Dec. II, p. 36, Pl. XX, 1875.

Emended description.—Polypary sword-shaped, robust, apparently concavo-convex in section; 20 mm. or more in length; widening steadily upwards from rounded base to 5 mm. or more. Thecae distinct; about 14 in 10 mm.; in contact for greater part of length; outer walls finely reticulate. Well-developed clathria with sub-regular and polygonal meshes, larger meshes being sometimes visible along medial axis. Nearly straight thecal walls inclined from 40° to 60° in forms having straight medial strand; more curved and at a greater angle when arising from zigzagged strand. Thecal apertures D-shaped; curved margin free, straight side attached to wall of next theca.

Remarks.—This graptolite conforms to Holm's amplified definition of the genus *Stomatograptus* (10) in its large medial

meshes and in its apertures. Ruedemann (13) records large medial meshes in *Retiolites*, but the apertures in the form here discussed determine its generic position. McCoy's holotype from Locality Ba 56 and 57, Quarter Sheet 1 NW, north-west of Keilor, is very indistinct and imperfect; better specimens have since been obtained, both from the type locality and from Enoch's Point, some of which we have made plesiotypes.

Associated graptolites, Horizon, and Locality.—The same as for *Monograptus aplini*.

DESCRIPTION OF PLATES.

Except where otherwise mentioned, drawings were made with a camera lucida, and specimens are from the Geological Survey Collection.

Plate XX.

Fig. 1. *Didymograptus acriculus*, sp. nov. *a*. Distal thecae No. 22811; syntype. *b*. Proximal region; sicula and branches compressed at different angles; No. 23507, syntype. Bendigo East. ×4.

Fig. 2. *Didymograptus mendicus*, sp. nov. No. 24747; holotype. Bendigo East. ×4.

Fig. 3. *Tetragraptus chapmani*, sp. nov. *a*. No. 24985; holotype. *b*. No. 25080; paratype. Blackwood. ×4.

Fig. 4. *Ptcrograptus lyricus*, sp. nov. No. 12297; holotype. Allot. 27B, Parish of Hastings. ×4.

Fig. 5. *Climacograptus uncinatus*, sp. nov. *a*. Subscalariform aspect; No. 26686; syntype. *b*. and *c*. Scalariform aspect, Spec. 26757; syntype. Yarra Track. *a*, ×6; *b*, *c*, ×4.

Fig. 6. *Climacograptus subminimus*, sp. nov. *a*. No. 22985; syntype. *b*. Proximal portion; No. 22985; syntype. Bendigo East. ×4.

Plate XXI.

Fig. 1. *Diplograptus* (*Glyptograptus*) *euglyphus* (Lapworth). No. 24738. Bendigo East; plesiotype. ×4.

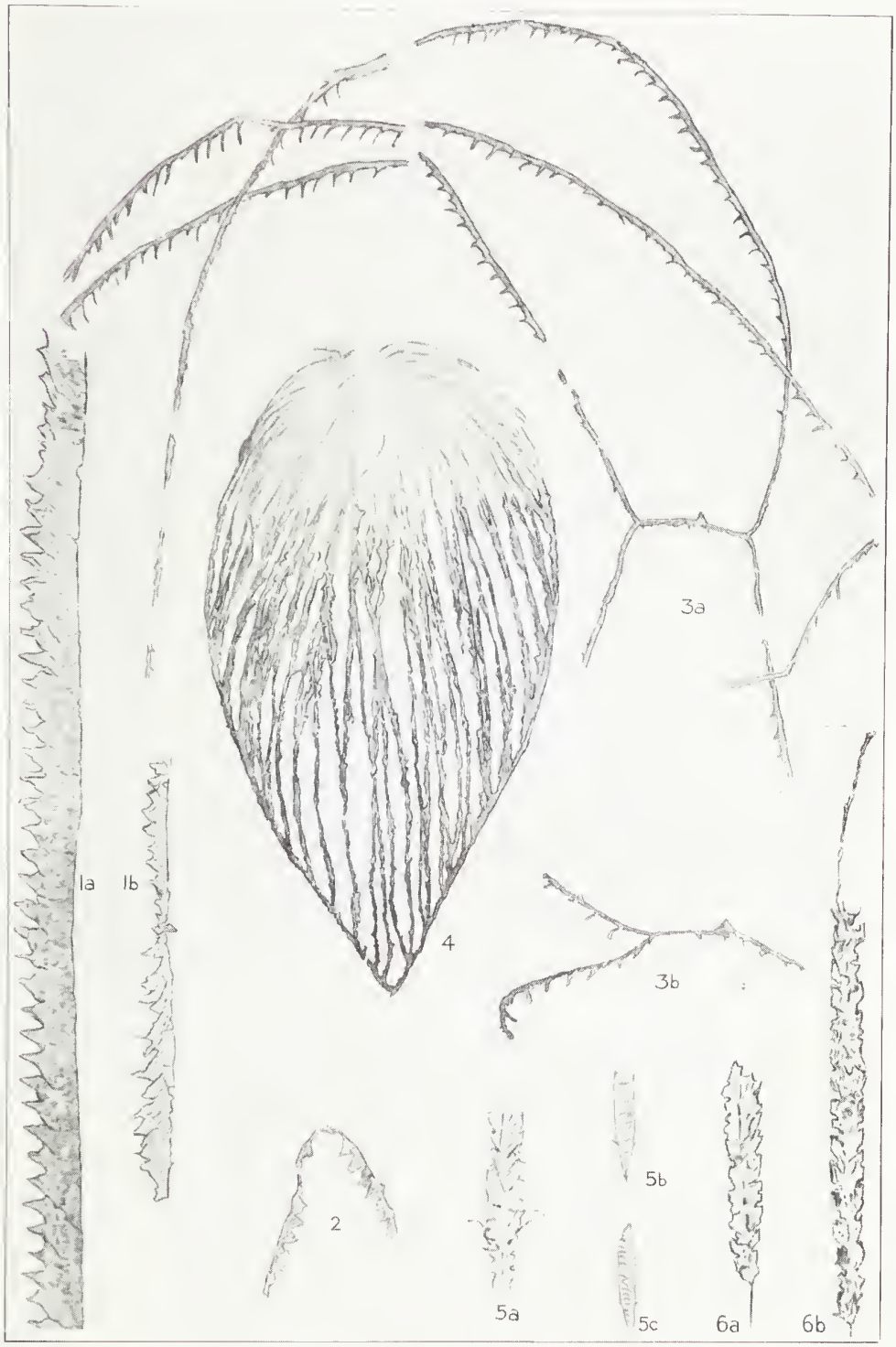
Fig. 2. *Diplograptus* (*Glyptograptus*) *euglyphus* (Lapw.) var. *sepositus* nov. *a*. No. 22427; syntype. *b*. Distal thecae; No. 22902; syntype. *c*. No. 22385; syntype. *d*. Proximal end; No. 22909. *e*. No. 22385; syntype. Bendigo East. ×4.

Fig. 3. *Diplograptus* (*Amplexograptus*) cf. *perexcavatus* (Lapworth). Distorted polypary; No. 23776, plesiotype. Bendigo East. ×4.

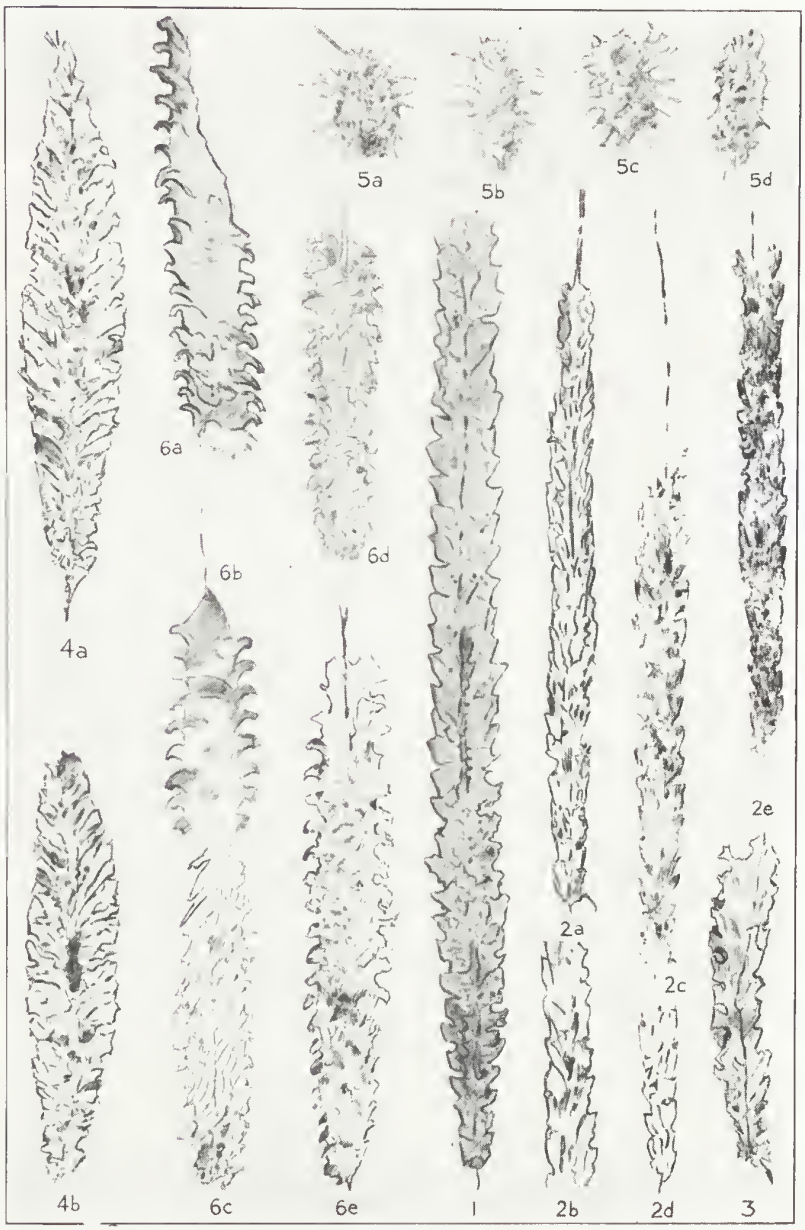
Fig. 4. *Trigonograptus* sp. *a*. No. 22980. *b*. Common mode of preservation; No. 22865. Bendigo East. ×4.

Fig. 5. *Glossograptus pilosus*, sp. nov. *a*. No. 23779; syntype. *b*. No. 22913; syntype. *c*. No. 23779. *d*. No. 23914. Bendigo East. ×4.

Fig. 6. *Cryptograptus circinus*, sp. nov. *a*. Proximal portion; spec. KD., W. J. Harris Coll. *b*. Distal portion of same specimen. *c*. Polypary showing torsion; No. 22887. *d*. No. 24722; syntype. *e*. No. 22913; syntype. Bendigo East. ×4.



Graptolites



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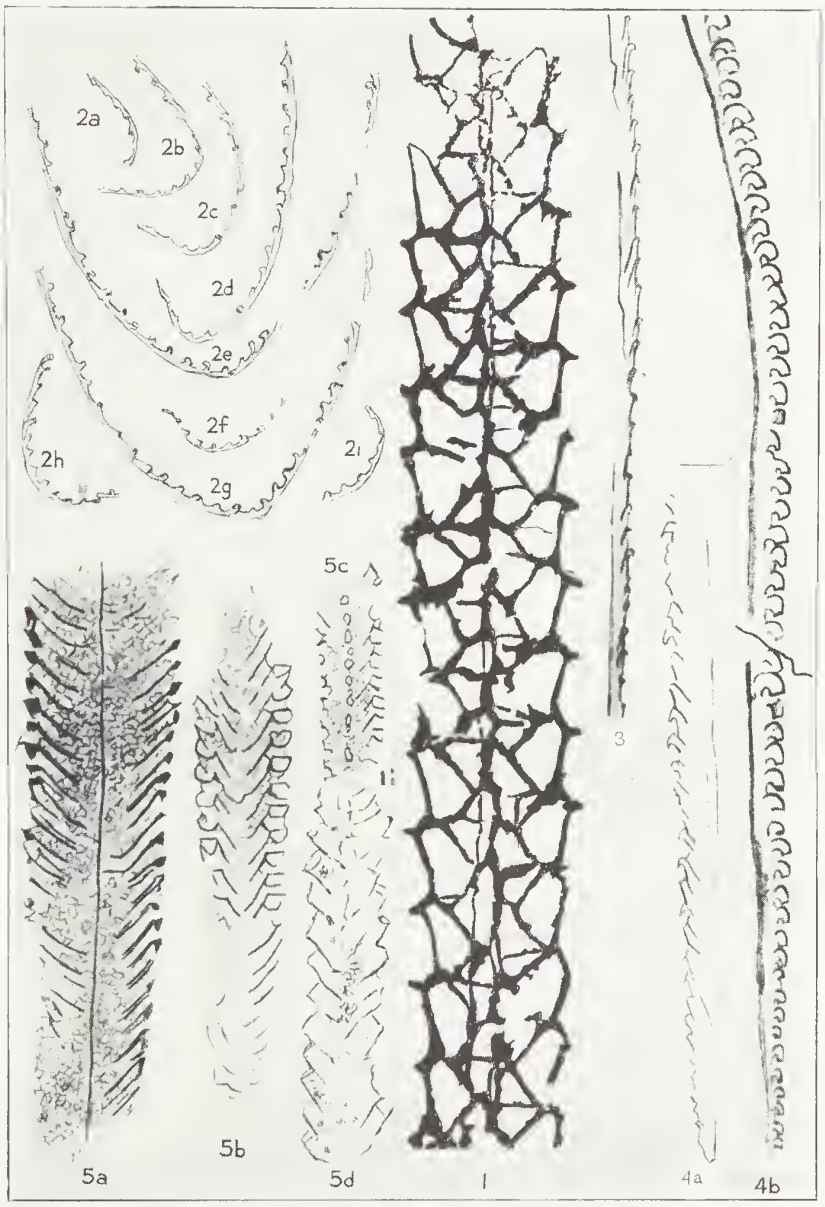

Graptolites

Plate XXII.

Fig. 1. *Retiograptus pulcherrimus*, sp. nov. Distal portion (from a photograph); No. 26700 ; holotype. Yarra Track. ×7.

Fig. 2. *Monograptus aplini* T. S. Hall (emend. Keble & Harris). *a*. Holotype refigured ; Nat. Museum Coll. *b*. Spec. K, Harris Coll. *c*. No. 29267. *d*. No. 29274. *e*. No. 29274. *f*. Spec. K, Harris Coll. *g*. No. 29274. *h*. Specimen on slab with holotype. *i*. No. 29297. *e*. and *h*. from Keilor, the rest from Enoch's Point. (*b-h*, plesiotypes). ×4.

Fig. 3. *Monograptus* cf. *scanius* Tullberg. No. 29252. Enoch's Point. ×4.

Fig. 4. *Monograptus pandus* (Lapworth). *a*. Polypary showing thecal apertures turned away ; No. 29245. *b*. Common aspect ; No. 29277. Enoch's Point. (*a*, *b*, pleotypes). ×4.

Fig. 5. *Stomatograptus australis* (McCoy). *a*. No. 29292 ; plesiotype. *b*. No. 29293 ; plesiotype. *c*. No. 29297 ; plesiotype. *d*. McCoy's holotype ; Nat. Museum Coll. Holotype from Keilor, the rest from Enoch's Point. ×4.

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END OF MEMOIR No. 8

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